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(71) Applicant *(for all designated States except US)*: **FISHER-ROSEMOUNT SYSTEMS, INC.** [US/US]; 8301 Cameron Road, Austin, TX 78754 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **ARMSTRONG, Steve** [US/US]; 5410 South Park Drive, Savage, MN 55378 (US). **HOKENESS, Scott** [US/US]; 17335 Jade Terrace, Lakeville, MN 55044 (US). **DOBROWSKI, Patrick** [US/US]; 408 Oakland Lane, Burnsville, MN 55337 (US).

(74) Agent: **HEPPERMANN, Roger, A.**; Marshall, Gerstein & Borun LLP, 6300 Sears Tower, 233 South Wacker Drive, Chicago, IL 60606 (US).

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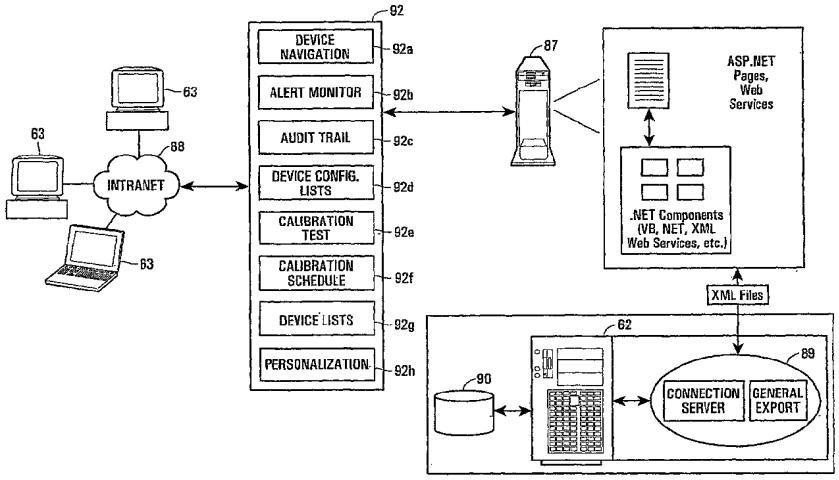
(54) Title: REMOTE DATA VISUALIZATION WITHIN AN ASSET DATA SYSTEM FOR A PROCESS PLANT



(57) Abstract: A process plant data collection and viewing system uses a common navigational tree structure and one or more common display formats to enable a user to remotely view, in a similar and consistent manner, information obtained from different applications or data sources within a process plant at any desired level of integration, even though the actual data from the multiple different data applications or data sources may be collected and organized in different manners by different data sources using a primary data visualization platform. Because predetermined common visualization screens provide predetermined formats of information at different levels of data integration, a user can easily remotely navigate through the data stored in the database or collected by the different data sources at higher or lower levels of data integration without having to directly access that data from the data sources themselves and without needing direct access to the primary data collection and visualization platform.

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REMOTE DATA VISUALIZATION WITHIN AN ASSET DATA SYSTEM FOR A PROCESS PLANT

RELATED APPLICATIONS

[0001] This is a continuation-in-part of U.S. Patent Application Serial No. 10/394,683, entitled "Data Visualization Within an Integrated Asset Data System for a Process Plant" which was filed on March 21, 2003 and which is hereby expressly incorporated by reference herein.

FIELD OF TECHNOLOGY

[0002] This patent relates generally to process plant maintenance, control and viewing applications and, more particularly, to the remote visualization of information stored in or associated with an asset data system used to collect data associated with one or more data sources within a process plant.

BACKGROUND

[0003] Process plants, such as those used in chemical, petroleum or other industries, typically include one or more centralized or decentralized process controllers communicatively coupled to at least one host or operator workstation and to one or more process control and instrumentation devices, such as field devices, via analog, digital or combined analog/digital buses. Field devices, which may be, for example valves, valve positioners, switches, transmitters, and sensors (e.g., temperature, pressure and flow rate sensors), perform functions within the process such as increasing or decreasing fluid flow and measuring process parameters. The process controller receives signals indicative of process measurements or process variables made by or associated with the field devices and/or other information pertaining to the field devices, uses this information to implement a control routine and then generates control signals which are sent over one or more of the buses or other communication lines to the field devices to control the operation of the process. Information from the field devices and the controller is typically made available to one or more applications executed by operator workstations to enable an operator to perform desired functions with respect to the process, such as viewing the current state of the process, modifying the operation of the process, etc.

[0004] While a typical process plant has many process control and instrumentation devices, such as valves, transmitters, sensors, etc. connected to one or more process controllers which execute software that controls these devices during the operation of the process, there are many other supporting devices which are also necessary for or related to

process operation. These additional devices include, for example, power supply equipment, power generation and distribution equipment, rotating equipment such as turbines, etc., which are located at numerous places in a typical plant. While this additional equipment does not necessarily create or use process variables and, in many instances, is not controlled or even coupled to a process controller for the purpose of affecting the process operation, this equipment is nevertheless important to and ultimately necessary for proper operation of the process.

[0005] As a result, many process plants, and especially those which use smart field devices, include applications that are used to help monitor and maintain the devices within the plant regardless of whether these devices are process control and instrumentation devices or are other types of devices. For example, the Asset Management Solutions (AMS) application sold by Emerson Process Management, enables communication with and stores data pertaining to field devices to ascertain and track the operating state of the field devices. An example of such a system is disclosed in U.S. Patent Number 5,960,214 entitled "Integrated Communication Network for use in a Field Device Management System." In some instances, the AMS application may be used to communicate with devices to change parameters within the devices, to cause the devices to run applications on themselves, such as self calibration routines or self diagnostic routines, to obtain information about the status or health of the devices, etc. This information may be stored and used by a maintenance person to monitor and maintain these devices. Likewise, there are other types of applications which are used to monitor other types of devices, such as rotating equipment and power generation and supply devices. These other applications are typically available to the maintenance persons and are used to monitor and maintain the devices within a process plant. In many cases, however, outside service organizations may perform services related to monitoring process performance and equipment. In these cases, the outside service organizations acquire the data they need, run typically proprietary applications to analyze the data and merely provide results and recommendations to the process plant personnel.

[0006] Still further, many process plants have other computers associated therewith which execute applications related to business functions or maintenance functions. For example, some plants include computers which execute applications associated with ordering raw materials, replacement parts or devices for the plant, applications related to forecasting sales and production needs, etc.

[0007] Typically, the functions associated with the process control activities, the device and equipment maintenance and monitoring activities, and the business activities are separated, both in the location in which these activities take place and in the personnel who typically perform these activities. Furthermore, the different people involved in these different functions generally use different tools, such as different applications run on different computers, to perform the different functions. In many instances, these different tools collect or use different types of data associated with or collected from the devices or equipment within the process and are set up differently to collect the data they need. For example, process control operators who generally oversee the day to day operation of the process and who are primarily responsible for assuring the quality and continuity of the process operation typically affect the process by setting and changing set points within the process, tuning loops of the process, scheduling process operations such as batch operations, etc. These process control operators may use available tools for diagnosing and correcting process control problems within a process control system, including, for example, auto-tuners, loop analyzers, neural network systems, etc. Process control operators also receive process variable information from the process via one or more process controllers which provide information to the operators about the operation of the process, including alarms generated within the process. Still further, it is typical to provide control optimizers, such as real time optimizers, within a plant to optimize the control activities of the process plant. Such optimizers typically use complex models of the plant to predict how inputs may be changed to optimize operation of the plant with respect to some desired optimization variable such as, for example, profit. While this information may be provided to the process control operator via standard user interface devices, the process control operators are generally interested in viewing and accessing the information within the applications based on how the process plant is set up and configured from a control standpoint.

[0008] On the other hand, maintenance personnel who are primarily responsible for assuring that the actual equipment within the process is operating efficiently and for repairing and replacing malfunctioning equipment, use tools such as maintenance interfaces, the AMS application discussed above, as well and many other diagnostic tools which provide information about operating states of the devices within the process. Maintenance persons also schedule maintenance activities which may require shut down of portions of the plant. For many newer types of process devices and equipment, generally called smart field devices, the devices themselves may include detection and diagnostic tools which automatically sense

problems with the operation of the device and automatically report these problems to a maintenance person via a standard maintenance interface. For example, the AMS software reports device status and diagnostic information to the maintenance person and provides communication and other tools that enable the maintenance person to determine what is happening in devices and to access device information provided by devices. Typically, maintenance interfaces and maintenance personnel are located apart from process control operators, although this is not always the case. For example, in some process plants, process control operators may perform the duties of maintenance persons or vice versa, or the different people responsible for these functions may use the same interface. None-the-less, maintenance personnel are typically interested in viewing and accessing the information from the applications available thereto based on how the equipment is set up or located in the plant, or on other logical bases related to the equipment within the plant. This organization is typically different than the control organization.

[0009] Still further, some tasks, such as monitoring equipment, testing the operation of devices, determining if the plant is running in an optimal manner, etc. are performed by outside consultants or service companies who measure the data needed, perform an analysis and then provide only the results of the analysis back to the plant personnel. In these cases, the data is typically collected and stored in a proprietary manner and may be organized in a still different manner as the organization of the data is geared to the particular application that is collecting, generating and using the data.

[0010] Many of the different applications discussed above use a navigational tree or other similar structure for organizing and enabling a user of the application to view and access the different data or information within or available to the application. In most cases, these navigational tree structures are similar in nature to the navigational tree structures used in Microsoft Outlook™, Windows™, etc., and are provided in these applications to enable a user to access or drill down into a relevant area, subarea, etc., of the plant to perform functions using the application. Usually, although not always, the applications use a navigational tree structure with nomenclature provided by the S88 standard, which logically divides a process plant into smaller and smaller entities, as, starting at the highest level, Enterprise, Site, Area, Process Cell, Unit, Equipment Module and Control Module. Applications using a navigational tree structure based on the S88 standard may provide some or all of these headings within a navigational tree to enable a user to access information or perform functions associated with the process plant.

[0011] There is currently a need by some users, such as persons responsible for business applications, like those which order parts, supplies, raw materials, or which assist in making strategic business decisions such as choosing which products to manufacture, what variables to optimize within the plant, etc., to have access to data from more than one of the applications discussed above, to thereby understand or view the operation of the plant from a higher level than provided by any of the individual applications within the plant. While, in the past, these persons have not had much access to the actual data generated within the plant by the different applications, U.S. Patent Application Serial No. 10/087,308, entitled "Data Sharing in a Process Plant," filed March 1, 2002 and assigned to the assignee hereof, the disclosure of which is hereby expressly incorporated herein, discloses a method of combining the data from various different sources of data in a central database to make that data available on a more general basis to business personnel, as well as to the different users and applications within the process plant.

[0012] However, as noted above, the different applications collecting this data are designed to be used within the process plant to perform very different functions on, typically, a subset of the devices or equipment within the plant. The applications are, therefore, developed to organize and provide viewing of the data collected and generated thereby in sometimes slightly different and in sometimes very different manners. As a result, while these applications can share data with one another and with a centralized database, there is no simple technique of organizing the shared data in a manner that makes sense or that is easy to use by a person viewing or accessing all of the data from the different applications or a way of presenting that data to a user in an organized and easily understood manner. While U.S. Patent Application Serial No. 10/394,683 discloses a method of integrating this data for visualization in a common format, thereby making it easy to view the data from different devices and applications in a consistent format, it is also desirable to be able to access and view this data from various remote sites, such as sites connected to the central data integration site via a web connection to allow wider or more complete use of this data by different users.

SUMMARY OF DISCLOSURE

[0013] A process plant data collection and viewing system uses a common or integrated navigational tree structure and one or more common display formats to enable a user to view, in a similar and consistent manner, information obtained from different applications or data sources within a process plant at any desired level of integration, even though the actual data

from the multiple different data applications or data sources may be collected and organized in different manners by different data sources. Additionally, one or more remote connections or sites may be set up to access data from a central data collection and integration source, thereby enabling users to easily and quickly access the integrated data at various locations within a process plant or outside of the process plant via, for example, a web connection. Because a common visualization of information is provided remotely at different levels of data integration, a user can easily navigate through the data stored in the database or collected by the different data sources at higher or lower levels of data integration without having to contend with or encounter multiple different viewing formats for the same type of data. Additionally, the user can set up profiles to view the process plant data, obtain and print pre-established or pre-configured reports at a remote site and have easy and quick access to certain types of data without the need to load and execute the data integration program at the remote site, thereby making remote access to the integrated process data quicker and easier.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Fig. 1 is a block diagram of a process plant having an asset optimization database configured to receive and store data from many functional areas or applications within the process plant;

[0015] Fig. 2 is a block diagram of a data network associated with the process plant of Fig. 1 which may be used to provide data from many different applications within one or more process plants to an asset optimization database and then remotely to one or more remote data visualization sites;

[0016] Fig. 3 is a block diagram of a remote visualization system illustrating multiple remote sites configured to access and view plant data from a centralized or primary data integration and visualization platform associated with a process plant;

[0017] Fig. 4 is a block diagram of a remote data visualization system for remotely accessing and viewing predetermined types data in predetermined formats;

[0018] Fig. 5 is an example screen display illustrating a tags list data viewing format accessed remotely via a first section of a navigational tree browser;

[0019] Fig. 6 is an example screen display illustrating a pull down menu used to obtain additional data viewing formats in the screen of Fig. 5;

[0020] Fig. 7 is an example screen display illustrating an audit trail data viewing format accessed remotely via a first section of a navigational tree browser;

[0021] Fig. 8 is an example screen display illustrating a configuration summary data viewing format accessed remotely via a first section of a navigational tree browser;

[0022] Fig. 9 is an example screen display illustrating a configuration data viewing format accessed remotely via a first section of a navigational tree browser;

[0023] Fig. 10 is an example screen display illustrating a calibration test events data viewing format accessed remotely via a first section of a navigational tree browser;

[0024] Fig. 11 is an example screen display illustrating a device poll list alert data viewing format accessed remotely via a second section of a navigational tree browser;

[0025] Fig. 12 is an example screen display illustrating an audit trail data viewing format accessed remotely via a third portion of a navigational tree browser;

[0026] Fig. 13 is an example screen display illustrating a tags list viewing format accessed remotely via a fourth portion of a navigational tree browser;

[0027] Fig. 14 is an example screen display illustrating a calibration routes viewing format accessed remotely via a fifty portion of a navigational tree browser;

[0028] Fig. 15 is an example screen display illustrating a calibration schedule viewing format accessed remotely via a sixth portion of a navigational tree browser;

[0029] Fig. 16 is an example screen display illustrating an options page for specifying user viewing options that may be used in the data viewing screens of Figs. 5-15;

[0030] Fig. 17 is an example screen display illustrating a search engine used to search for data within a primary data visualization platform;

[0031] Fig. 18 is an example screen display illustrating a first navigational tree structure that may be used to integrate data from different applications or data sources in the process plant of Fig. 1;

[0032] Fig. 19 is an example screen display illustrating a second navigational tree structure that may be used to integrate data from different applications or data sources in the process plant of Fig. 1;

[0033] Fig. 20 is an example screen display produced by a mapping tool associated with the asset optimization database that enables an operator to manually specify mapping of navigational tree structures associated with different data sources into an integrated navigational tree associated with the asset optimization database;

[0034] Fig. 21 is an example screen display illustrating a third navigational tree structure that may be created and used to integrate data from different applications or data sources in the process plant of Fig. 1;

[0035] Fig. 22 is an example screen display illustrating a fourth navigational tree structure that provides access to data from different sources and that includes linking information;

[0036] Fig. 23 is an example screen display illustrating a simple navigational tree structure used to integrate data from an asset database and different applications or data sources in the process plant of Fig. 1 as well as a first visualization screen that displays data from the database and applications at a high level of integration in a first format;

[0037] Fig. 24 is an example screen display illustrating a second visualization screen that displays data from the database and applications at a high level of integration in a second format;

[0038] Fig. 25 is an example screen display illustrating a third visualization screen that displays data from the database and applications at a high level of integration in a third format;

[0039] Fig. 26 is an example screen display illustrating a visualization screen that displays data from the database and applications at a second and lower level of integration in the first format;

[0040] Fig. 27 is an example screen display illustrating a visualization screen that displays data from the database and applications at a third level of integration in the first format;

[0041] Fig. 28 is an example screen display illustrating a visualization screen that displays data from the database and applications at a fourth level of integration; and

[0042] Fig. 29 is an example screen display illustrating a visualization screen that links to other information associated with the database or applications.

DETAILED DESCRIPTION

[0043] Referring now to Fig. 1, a process plant 10 (which may be located in a single geographical location or at multiple geographical locations) includes a number of business and other computer systems interconnected with a number of control and maintenance systems by one or more communication networks. In particular, the process plant 10 includes one or more process control systems 12 and 14. The process control system 12 may be a traditional process control system such as a PROVOX or RS3 system or may be a DCS which

includes an operator interface 12A coupled to a controller 12B and to input/output (I/O) cards 12C which, in turn, are coupled to various field devices such as analog and Highway Addressable Remote Transmitter (HART) field devices 15. The process control system 14, which may be a distributed process control system, includes one or more operator interfaces 14A coupled to one or more distributed controllers 14B via a bus, such as an Ethernet bus. The controllers 14B may be, for example, DeltaV™ controllers sold by Fisher-Rosemount Systems, Inc. of Austin, Texas or any other desired type of controllers. The controllers 14B are connected via I/O devices to one or more field devices 16, such as for example, HART or Fieldbus field devices or any other smart or non-smart field devices including, for example, those that use any of the PROFIBUS®, WORLDFIP®, Device-Net®, AS-Interface and CAN protocols. As is known, the field devices 16 may provide analog or digital information to the controllers 14B related to process variables as well as to other device information. The operator interfaces 14A may store and execute applications 17 available to the process control operator for controlling the operation of the process including, for example, control optimizers, diagnostic experts, neural networks, tuners, etc. Additional control applications 17 may be stored in and executed by the controllers 12B and 14B if so desired and, in some cases, within field devices 16.

[0044] Still further, maintenance systems 18, such as computers executing the AMS application or any other device monitoring and communication applications 19 may be connected to the process control systems 12 and 14 or to the individual devices therein to perform maintenance and monitoring activities. For example, a maintenance computer 18 may be connected to the controller 12B and/or to the devices 15 via any desired communication lines or networks (including wireless or handheld device networks) to communicate with and, in some instances, reconfigure or perform other maintenance activities on the devices 15. Similarly, maintenance applications 19 such as the AMS application may be installed in and executed by one or more of the user interfaces 14A associated with the distributed process control system 14 to perform maintenance and monitoring functions, including data collection related to the operating status of the devices 16.

[0045] The process plant 10 also includes various rotating equipment 20, such as turbines, motors, etc. which are connected to a maintenance computer 22 via some permanent or temporary communication link (such as a bus, a wireless communication system or hand held devices which are connected to the equipment 20 to take readings and are then removed).

The maintenance computer 22 may store and execute known monitoring and diagnostic applications 23 provided by, for example, CSI Systems or other any other known applications used to diagnose, monitor and optimize the operating state of the rotating equipment 20. Maintenance personnel usually use the applications 23 to maintain and oversee the performance of rotating equipment 20 in the plant 10, to determine problems with the rotating equipment 20 and to determine when and if the rotating equipment 20 must be repaired or replaced. In some cases, outside consultants or service organizations may temporarily acquire or measure data pertaining to the equipment 20 and use this data to perform analyses for the equipment 20 to detect problems, poor performance or other issues effecting the equipment 20. In these cases, the computers running the analyses may not be connected to the rest of the system 10 via any communication line or may be connected only temporarily.

[0046] Similarly, a power generation and distribution system 24 having power generating and distribution equipment 25 associated with the plant 10 is connected via, for example, a bus, to another computer 26 which runs and oversees the operation of the power generating and distribution equipment 25 within the plant 10. The computer 26 may execute known power control and diagnostics applications 27 such as those provided by, for example, Liebert and ASCO or other companies to control and maintain the power generation and distribution equipment 25. In many cases, outside consultants or service organizations may use service applications that temporary acquire or measure data pertaining to the equipment 25 and use this data to perform analyses for the equipment 25 to detect problems, poor performance or other issues effecting the equipment 25. In these cases, the computers (such as the computer 26) running the analyses may not be connected to the rest of the system 10 via any communication line or may be connected only temporarily.

[0047] A computer system 30 (which may be, for example, a server) is communicatively connected via a communications network 32 to the computers or interfaces associated with the various functional systems within the plant 10, including the process control functions 12 and 14, the maintenance functions such as those implemented in the computers 18, 14A, 22 and 26 and the business functions. If desired, the communication interconnection 32 may be implemented using a web interface or communication structure of any other kind, including any local area network (LAN), wide area network (WAN), the internet, etc. In any event, the computer system 30 is communicatively connected to the traditional process control system 12 and to the maintenance interface 18 associated with that control system, is connected to the process control and/or maintenance interfaces 14A of the distributed process control

system 14, is connected to the rotating equipment maintenance computer 22 and to the power generation and distribution computer 26, all via the communication network 32 which may use any desired or appropriate LAN or WAN protocol to provide communications. The communication network 32 may be permanent or temporary (intermittent) as desired.

[0048] As illustrated in Fig. 1, the computer 30 is also connected via the same or a different communication network 33, such as a different intranet or internet connection like a World Wide Web connection, to business system computers and maintenance planning computers 35 and 36, which may execute, for example, enterprise resource planning (ERP), material resource planning (MRP), accounting, production and customer ordering systems, maintenance planning systems or any other desired business applications such as parts, supplies and raw materials ordering applications, production scheduling applications, etc. The computer 30 may also be connected via, for example, the communication network 32 or 33 to a plantwide LAN 37, a corporate WAN 38 as well as to one or more computer systems 40 that enable remote monitoring of or communication with the plant 10 from remote locations. The computer system 30, or any other computer connected to the communication networks 32 and 33 may include a configuration application and a configuration database that generates and stores configuration data pertaining to the configuration of the process plant 10 and the devices and elements within the process plant 10.

[0049] In one embodiment, the communications over the communication network 32 or 33 occur using the XML protocol. Here, data from each of the computers 12A, 18, 14A, 22, 26, 35, 36, etc. is wrapped in an XML wrapper and is sent to an XML data server which may be located in, for example, the computer 30. Because XML is a descriptive language, the server can process any type of data. At the server, if necessary, the data is encapsulated with a new XML wrapper, i.e., this data is mapped from one XML schema to one or more other XML schemas which are created for each of the receiving applications. Thus, each data originator can wrap its data using a schema understood or convenient for that device or application, and each receiving application can receive the data in a different schema used for or understood by the receiving application. The server is configured to map one schema to another schema depending on the source and destination(s) of the data. If desired, the server may also perform certain data processing functions or other functions based on the receipt of data. The mapping and processing function rules are set up and stored in the server prior to operation of the system described herein. In this manner, data may be sent from any one application to one or more other applications.

[0050] Generally speaking, the computer 30 (which may be or include a traditional server) includes an asset optimization database 50 (and an associated data collection application) that collects data and other information generated by, for example, the process control systems 12 and 14, the maintenance systems 18, 22 and 26 and the business systems 35 and 36 as well as information generated by data analysis tools executed in each of these systems and stores this data in a database. The asset optimization database 50 may include an expert engine 51 that may be based on, for example, the OZ expert system currently provided by NEXUS, or any other type of expert system including, for example, any type of data mining system. The asset optimization expert 51 operates to analyze and distribute data as necessary within the asset optimization database 50.

[0051] In the past, the various process control systems 12 and 14 and the power generating and maintenance systems 22 and 26 have not been interconnected with each other in a manner that enables them to share data generated in or collected by each of these systems in a useful manner. As a result, the manner in which the different applications 17, 19, 23, 27, etc. organize and enable a user to view data differs from application to application. However, in the plant 10 of Fig. 1, the applications 17, 19, 23, 27, etc. are now communicatively connected through and share data with the asset optimization database 50. None-the-less each of the applications 17, 19, 23, 27, etc. still typically provides or organizes the data collected or generated thereby in a different manner using a different organizational or navigational tree and viewing software. To enable a consistent manner of viewing this data from the different applications, the asset optimization database 50 includes one or more navigational tree applications and databases 52 which may use an integrated navigational tree structure to organize the data received from the different applications within the process plant 10 to allow a user to view or access that data, either at the computer 30 or at a remote site 40, in a consistent manner using a single navigational tree.

[0052] In particular, the navigational tree applications 52 provide an automated manner of generating a navigational tree to be used in, for example, a web environment by all the users of the system, to view and access the data within the asset optimization database 50, even though that data comes from different sources and is organized in the different sources in different manners. In effect, the navigational tree applications 52, in conjunction with the asset optimization database 50, provide a higher level integration platform, in this case in the form of an asset optimization server, which receives and organizes information from multiple information sources (e.g., control applications, maintenance applications, equipment

monitoring applications, efficiency monitoring applications, etc.) even though each of the different information sources have a different manner of organizing the data provided thereby.

[0053] Fig. 2 illustrates a block diagram view of a set of applications 60 within a process plant communicatively interconnected via a web connection 61 with an asset optimization server 62 (which may be the computer 30 of Fig. 1 and which is also referred to herein as a primary data integration and viewing platform) in a manner in which the asset optimization server 62 provides a consistent and integrated organizational and navigational tree structure that can be used to provide a common viewing platform with respect to the data generated in or collected by the different applications 60, both at the primary or centralized data integration platform 62 and in remote platforms or computers 63 connected to the primary data integration platform 62 via, for example, internet communication connections. In particular, a control application server 64, a maintenance application server 66, a rotating equipment application server 68, an optimization application server 70, and an additional server 72 for other applications are communicatively connected to the asset optimization server 62 via a communication network 61. Of course, any other types and number of applications (also called data sources) could be connected in the system of Fig. 2. The communication network 61 may be any desired communication network such as a wide area network, the World Wide Web or any other desired type of web network. The communication network 61 may be a hardwired or wireless network, if so desired, using any desired communication protocol, such as HTML, etc. Each of the servers 62-72 includes any desired web services application 74 and web visualization application 76 which, as is known, enable communications over the web connection 61 and visualization of that information to a user interface. Generally speaking, the different applications 60 run on or associated with the different servers 64-72 may use different data organization, navigation and viewing structures such as different navigational trees. Still further, the asset optimization server 62 may be communicatively coupled to business system applications or any other applications via a web connection or any other desired communication network. If desired, the asset optimization server 62 may be connected directly to one or more process controllers or field devices via proprietary busses, Ethernet busses, or a combination thereof to collect data from and about the field devices and other devices within the process plant.

[0054] As illustrated in Fig. 2, the asset optimization server 62 includes a microprocessor 77, a user interface 78 and a memory 79 which stores a number of applications and databases

which operate to integrate both plant data from the different applications 60 as well as navigational tree structures associated with the applications 60 into an integrated navigational tree structure and which operate to provide a common viewing scheme for the data from the different data sources. In one embodiment, the asset optimization server 62 includes a plant information database 80 which stores data from the different data source applications 60 communicatively connected to the asset optimization database server 62 and a navigational tree database 82 which stores navigational trees 83a associated with each of the different applications 60, as well as an integrated navigational tree 83b which incorporates or integrates the navigational trees of the different applications 60. The asset optimization server 62 further includes a user interface application 84 which provides information to the user via the user interface 78 pertaining to the data stored in the plant information database 80 using the integrated navigational tree 83b.

[0055] Still further, if desired, a data integration application 86 may be provided to integrate the data from the different applications 60 into the plant information database 80 using the integrated navigational tree 83b and, in some cases, may provide the user with the ability to map the navigational tree structures 83a for the applications 60 into the integrated navigational tree structure 83b. In one embodiment, the integration application 86 may include a default navigational tree structure which may be used to integrate the data within each of the navigational tree structures of the applications 60. This default navigational tree structure may be based on, for example, the plant hierarchy used in the S88 standard. However, the integration application 86 may enable a user or different users to create additional navigational tree structures which may be used to integrate the navigational trees of the different applications 60 in different manners. Of course, if desired, the default navigational tree structure may be created by a user using the data integration application 86 and or the user interface application 84.

[0056] Generally, the asset optimization server 62 stores each of the different navigational tree structures 83a of the different applications 60 and relates or maps the data within these navigational trees to a single integrated navigational tree structure 83b which may be used to view and access the data within the asset optimization database 80. After the mapping is specified or complete, the data associated with each of the different tree structures of the different applications is organized within the integrated navigational tree for viewing by any user, including users of the applications at the servers 62-72 or any other users who have access to the server 62, such as business systems users. If desired, a single navigational tree

structure may be used by, for example, a configuration application and this single navigational tree structure may be accessed and used by every user in the process plant or enterprise system associated with the process plant so that each user views the data from the plant in the same manner. If desired, each user may access the single navigational tree structure over the web or any other communication network that connects the different users to the configuration application.

[0057] During operation, the different applications 60 may send their respective navigational tree structures used in these applications to the asset optimization server 62 where these tree structures may be stored in the database 82. The integration application 86 may automatically identify a correspondence between the different categories of a navigational tree associated with one of the applications and the categories of the integrated tree structure 83b. In some cases, a user may manually specify a correspondence between categories of the navigational tree of the particular application 60 and categories within the integrated or default navigational tree 83b. If the categories of the application 60 are known to correspond in some manner to some standard, such as the S88 standard, the integration application 86 may identify this correspondence automatically. On the other hand, a user may create a user preferred navigational tree and identify the correspondence between the different categories of the navigational tree of one of the applications 60 and the user created integrated navigational tree. Of course, it will be understood that the default or integrated navigational tree structure may include categories not represented or present in certain ones of the applications sending data thereto because the data flow is from the applications 60 to the server 62. However, the default or integrated navigational tree should have a category or level that is or can be associated with each of the categories of the navigational trees of the different applications 60.

[0058] Of course, the integration application 86 provides mapping between the navigational trees of each of the applications 60 (which are sending data to the asset optimization server 62) and the integrated navigational tree 83b and may perform this mapping when, for example, an application is brought on-line or is otherwise integrated within the asset optimization functions of the process plant 10. Thereafter, each of the applications 60 provides data to the server 62 along with enough information to enable the server 62 to categorize this data according the navigational tree structure of the application 60 which sends the data. The server 62 and, in particular, the integration application 86 may store the data as being associated with the proper navigation tree category or categories of the

integrated navigational tree structure 83b being used to provide an integrated view. Of course, the data itself is stored in the plant information database 80 for future access. Thereafter, the user interface application 84 may enable a user or operator to access the integrated navigational tree 83b having the data from the different applications referenced thereby to gain access to the data stored in the plant information database 80 in a consistent and integrated manner.

[0059] In one embodiment, the integrated navigational tree 83b may be organized according to logical areas, such in instrumentation, mechanical, and performance areas, or in physical areas, such as areas of the plant. Of course, any other desired organization can be used within the integrated navigational tree 83b. When the integrated navigational tree 83b is constructed according to logical units, the different data from the different applications (which typically falls within different logical groupings) may be separated into different sub-headings or categories under the tree, with those subheadings or categories either being standard navigational tree headings or mimicking the actual navigational tree structure associated with the different applications. In one embodiment, each of the information servers 64-72 serves its plant tree and the components thereof (including headings) to the requesting application (i.e., the asset optimization server 62). The integration application 86 then uses the obtained information to merge the various plant tree components. If desired, components of the original navigational tree of an application can be tracked by the original information server (e.g., the maintenance server 64, etc.) and if any changes take place, the asset optimization server 62 may be updated using push technology. Alternatively, the asset optimization server 62 can periodically poll the servers 64-72 to receive and keep track of the changes made in the navigational trees of those servers (or the applications run on or associated with those servers). In this manner, data that is added to, deleted from or changed within the applications 60 is mirrored or sent to the asset optimization server 62 and stored therein. Furthermore, the reflection or depiction of the devices or other entities within navigational tree of these applications is sent to the asset optimization server 62 and reflected in or mapped to the integrated navigational tree 83b so that data is now available and viewable by a user of the asset optimization database 50 via the integrated navigational tree 83b.

[0060] After the asset data is collected in the database 80, it may be easily accessed and viewed from the remote sites 63. In particular, each of the remote sites includes a processor 63a, a user interface 63b, such as a viewing screen, and a memory 63c. Internet access

applications, such as typical internet browsers, may be stored in the memory 63c and may generally be executed on the processor 63a to communicate with the primary data visualization platform 62. Furthermore, the remote sites 63 may store one or more remote data access applications which use the internet browser to poll for specific information or data in specific data formats from the primary data visualization platform 62 and to present this data to the user at the remote site 63, which makes this data easy to obtain and access over the internet connection without having to have all of the data collection and integration applications present in the primary data visualization site 62 loaded onto or running at the remote sites 63. As discussed in more detail below, these remote data access applications may include one or more web modules which are associated with obtaining different kinds of data in different data formats from the primary data visualization platform 63.

[0061] Fig. 3 illustrates the communication connections between the remote data visualization platforms 63 and the primary or centralized data collection and visualization platform 62 of Fig. 2, by which the remote data visualization platforms 63 are able to easily access and display the data stored in and collected by the primary data collection and visualization platform 62. The remote platforms 63, which may be any types of computing devices, including desktop computers, laptop computers, personal data assistants (PDAs), etc., are connected to a web server 87 via, for example, an internet communication connection 88. The remote platforms 63 may connect to the internet 88 using any desired connection hardware and software, including wireless connections, dial-up connections, broadband connections, T-1 lines, etc. The web server 87 is, in turn, connected to a communication interface 89 associated with the primary server 62 and may communicate with the communication interface 89 using XML files or in an XML format. The communication interface 89 may include a connection server, a generic export server, etc. to perform standard communication functions.

[0062] As illustrated in Fig. 3, the primary data collection and visualization platform 62 is connected to a database 90 which stores plant data as collected by the server 62. The database 90 may be, for example, an SQL server/database and may fulfill the function of the database 80 of Fig. 2. Generally speaking, the primary data visualization platform 62 will communicate with the web server 87 to provide data polled by the web server 87 in XML files which are set up or prepared in predetermined formats to present data quickly and easily to the web server 87.

[0063] The information or data obtained from the primary data collection and visualization platform 62 is sent to the web server 87 using the HTTP protocol and is in the form of HTML pages. As illustrated in Fig. 3, Active Server Page (ASP) documents may be located in the web server 87 and be executed. The ASP documents may use .NET components to query the primary data collection and visualization platform 62 for specific types of data and receive this data back in the form of streamed (not stored) XML data. This XML data is then processed immediately using, for example, the XSLT language and transformed into HTML data for display in a standard browser such as the Microsoft Internet Explorer.

[0064] The remote data visualization platforms 63 communicate with the web server 87 using various objects identified in Fig. 3 as object modules 92a-92h. The object modules 92a-92h generally have elements stored in the remote platforms 63 which, when called for a certain type of data, make a call to the server 87 for that data. The server 87 then uses and application which respond to these calls to acquire specific types of data (associated with the calls) in specific formats from the primary data visualization platform 62 via the ASP documents. The objects 92a-92h thereby make calls to the server 87 for specific types of information which is sent to the web server 87 in the form of XML or HTML files and is converted in a streaming manner into web pages to be sent back to the remote sites 63 for viewing by the users at those sites. Because the objects 92a-92h make the calls for specific types of data, which data profiles may be actually stored in the web server 87 or the primary server 62, the entire database 90 does not have to be loaded into or sent to the remote computers 63. Instead, only the data being requested by the call as wrapped in a known XML file is sent from the server 62 to the remote sites 63. As a result, the communications and data calls over the internet 88 are made in a manner that reduces the amount of data that needs to be sent to the remote sites 63 and to increase the speed at which data is sent to the remote sites 63.

[0065] As noted above, the web server 87 may implement, for example, an ASP.NET framework which creates web pages and provides traditional web services using standard .NET components, such as VBNET, XML, Web services, etc. Because the web server 87 may communicate with the interface 89 using XML files, the information called from the server 62 and the database 90 may be advantageously saved as XML documents in the server 87 for easy delivery to the remote platforms 63. Furthermore, because each of the objects 92a-92h has one or more predetermined display formats associated therewith, the data in the

XML documents may be easily stored and converted to web pages based on the predetermined requirements of a particular object.

[0066] Thus, the server 87, in conjunction with the interface 89, creates a data exchange layer in which the core .NET components provide communication between the web application (in the server 87) and the com interfaces which, in turn, interact in the primary server 62 to obtain the requested data. Thus, all of the web modules 92 essentially communicate with the .NET components for services and the .NET components communicate with the interface 89 which returns appropriate XML streams. The data exchange layer operates to extract the required data from the XML streams and returns this data to the calling object in the web page format. This data layer also performs the task of saving files for the administrator into the server 87. Of course, all of the modules 92 will perform calls to methods associated with the web application in the server 87 (i.e., in the data exchange layer) to send and receive predetermined types of data to and from the server 62.

[0067] As will be understood, the server 87 may be built on the Microsoft .NET framework to include a set of programming tools and infrastructure that enable the creation, deployment, management, and aggregation of XML web services and .NET experiences, which are the means for end users to interact with .NET. Some of the features of the product may include the web based read only application, which co-exists with the server application and supplements the same, to provide a standard Internet browser look and feel. In one embodiment, this application may use XML data access services of existing COM/DCOM components to extract required data from server 62, and may include multiple web access through the intranet with Built-in Form level authentication.

[0068] The hardware configuration of Fig. 3 illustrates two separate servers for use in providing communications between the remote application modules 92, and the database 90, wherein the first server is used for the primary data visualization application 62 with the database 90 and the second sever 87 may be execute the web application for providing communications to the remote sites 63. Alternatively, a single server may be used to perform this communication. In this single server approach, all base software such as the web server software, the remote call application, and the database server for accessing the database 90 may be loaded in and executed in one server. In this embodiment, no special configuration is required as all applications reside on the same server, wherein the remote sites 63

communicate directly with the single server directly through a plant wide intranet, a local area network, the World Wide Web, etc.

[0069] As noted above, the various remote data visualization platforms 63 generally use the pre-configured web modules 92 to access data from the primary data visualization platform 62 (and ultimately the database 90). These web modules 92 may include, for example, a device navigation module 92a which may enable or allow navigation between various devices for which data is stored in the database 90, an alert monitor 92b which may enable or allow navigation and viewing of current or past alerts (including alarms) generated with respect to the field devices and other devices within the process plant, an audit trail module 92c which allows a remote user to view audit trail data stored in the database 90, a device configuration lists module 92d which enables a remote user to view device configuration data, a calibration test module 92e which enables a remote user to run calibration tests and to view calibration data stored by or for the devices stored in the database 90, a calibration schedule module 92f which enables a remote user to view and possibly change calibration schedules for various field devices or other devices within the process plant, a device lists module 92g which enables a remote user to view and navigate a list of devices associated with the process plant and a personalization module 92h which may access personalized data or data pages previously configured or defined by the user of the remote site 63. Of course, other web modules may be used and stored in the remote data visualization platforms 63 to access and view other types of data stored in the database 90 in a quick and easy manner. As indicated above, the modules 92 perform calls to the server 87 and cause the server 87 to interact with the server 62 to obtain the data required or requested at the remote site 63 in a common or consistent format.

[0070] Fig. 4 illustrates a generic viewing screen that may be used to present the different types of data associated with the modules 92 of Fig. 3 at the remote data visualization sites 63. In particular, the display screen 93 of any of the remote data visualization platforms 63 may be configured to include two general areas or panes, including an object browser area 94 and an object viewer area 95. The object browser area 94 of the screen 93 generally includes one or more browser structures 94a-94g, which may be, for example, a navigational tree structure or other browser structure, tailored to allow a user to select objects of interest for display. The browser sections 94a-94b may be browsed and items therein selected to obtain more information from the primary data visualization platform 62. The selection within the

browser sections 94a-94b initiates a call, via one of the modules 92 of Fig. 3, for particular data to be displayed in a particular format.

[0071] On the other hand, the object viewer portion 95 uses one of a set of generalized display formats indicated by reference numbers 95a-95f to display information about an item or object selected within the object browser 94. These data formats specify the ASP documents to be used to access and display the data. As illustrated in Fig. 4, an application presentation layer 96 (which may communicate with the modules 92) interfaces between the remote sites and the interface 89 within the primary data visualization server 62 to obtain the information specified by the selection of one of the browser objects 94 and presents that information within the object view 95 in a predefined display format. The web page including the display format may be generated with the appropriate data therein at the web server 87 (Fig. 3) which reduces the amount of data sent over the internet connection 88.

[0072] As illustrated in Fig. 4, the object browser area 94 may provide different predetermined options or headings for browsing information within and obtaining information from the primary data visualization platform 62 (and ultimately, the database 90). For example, a user may use a plant location hierarchy browser 94a to browse by plant location using the standard S88 categories including, for example, Areas, Units, Equipment, Control Modules, etc. The user can navigate through the plant database hierarchy (Area / Unit / Equipment / Control Module) using the browser 94a and examine the associated devices on the object viewer 95 using, for example, a tag lists format associated with the devices. This tags list format essentially displays the information associated with a selected section of the browser 94 as a list of tags of the devices and pertinent information for each of the tags. An example of such a display is illustrated in Fig. 5, wherein the browser section 94a is expanded under the plant location section to illustrate a number of individual elements. One of these elements, namely, the Satish element, is selected and the devices, listed by tags, associated with the Satish element are illustrated in the object viewer section 95. As seen in Fig. 5, the information for each tag includes the device tag, the manufacturer, device type, revision, supported communication protocol, serial number, status and plant area in which the device is located. However any other desired information can be illustrated instead or as well. Furthermore, the user may also select single or multiple tags by a mouse click to view additional detailed information about the devices associated with the selected tags.

[0073] As will be understood, the selection of one of the elements within the browser 94 or the object viewer 95 causes the associated web module 92 of Fig. 3 to place a call for the data associated with that element. That call, which is routed to the web server 87 of Fig. 3, causes the application within the web server 87 to obtain the data from the primary data viewing platform 62 and place this data in the appropriate predetermined web page format. As indicated by the format section 95a of Fig. 4, the tags list display may provide information pertaining to audit trail information, to a configuration summary, to configuration information and to calibration test events about one of more of the tags. As illustrated in Fig. 6, a user may obtain audit trail, configuration and calibration information about the tags which are selected in a select box section on the right hand column 97 of the object viewer screen 95 using a drop down menu 98. As an example, Fig. 7 illustrates audit trail information for selected tags within the screen of Fig. 6, Fig. 8 illustrates a configuration summary screen for multiple ones of the tags selected in Fig. 6, Fig. 9 illustrates an example detailed or complete configuration information screen pertaining to a particular tag within the screen of Fig. 6 and Fig. 10 illustrates an example calibration test events summary screen for selected devices within the screen of Fig. 6 illustrating the most recent calibration results for the selected tags.

[0074] In a similar manner, the user may use the browser 94b (of Fig. 4) to browse physical networks, such as the servers and data constructs used within the servers associated with the physical communication network of the process plant. More particularly, from the physical networks level 94b in the navigational tree 94, a user can view the devices physically connected to the system as a tag list page on the object viewer 95. The physical network may include any hardware attached to any of the nodes within the process plant. The user may obtain more detailed pages like audit trail, configuration parameters, calibration information, etc., from the tag list page in the manner illustrated above with respect to Figs. 6-10.

[0075] The alert monitor browser section 94c of Fig. 4 may be used to view alerts within the process plant. In particular, the alert monitor browser section 94c executes a diagnostic tool that the user can use to observe, for example, HART devices that the user may suspect of malfunctioning or reporting false data. The user can use the alert monitor 94c to poll such devices, to watch for device failures or patterns that need to be corrected, etc. Such an alert monitor screen for polling devices is illustrated in Fig. 11. The active alerts portion of the browser section 94c lists all the devices that were last known to have an alert condition while

the device poll list portion lists all the devices polled by the alert monitor tool. It will be understood that the alert monitor tool may be stored and executed in the primary server 62, or even in other devices, such as controllers, connected to the primary server 62. Furthermore, once implemented, the alert monitor view of Fig. 11, and the associated alert module 92b, may continue to poll for alert information and provide this updated alert information to the user at the remote platform 63. In this manner, the user at the remote platform 63 may view a live screen illustrating the alert data as it changes within the plant.

[0076] Moreover, the browser section 94d may be used to view audit trail information within the process plant. This audit trail information, which is illustrated in Fig. 12, may include historical records, which are also known as events, stored in the database 90. If desired, these events may be displayed according to or organized by device tags, by physical devices, or for the entire system. In the example formats 95d of Fig. 4, the events are grouped on six tabs in the audit trail window including, All, Application, Calibration, Configuration, Status Alerts, and System Maintenance. These different tabs may be selected or use to view audit trail information grouped by each of these categories. However, other groups or predetermined categories could be used to view audit trail information instead of or in addition to those listed in Fig. 4.

[0077] As illustrated in the example screen of Fig. 13, the browser section 94e may be used to directly view device tag lists and information associated therewith for devices, no matter where these devices are within the process plant. In particular, the section 94e may provide various reports related to the devices for which data is collected by the primary data viewing platform 62. This data may be accessed or reported using the categories of All Devices, which lists all the inventory of the devices in the plant organized by manufacturer, device protocol, device type, and device revision; Assigned Devices, which lists the devices that have been assigned to a control module in the plant database 90; Decommissioned Devices, which lists the devices that have been removed from the plant database 90 and are unavailable for assignment to the plant database 90; and Spare Devices, which lists the devices that are not currently assigned to a control module in the plant database 90. Furthermore, the different types of information (such as the audit trail, configuration and calibration information) about these devices may be viewed via a pull down menu. It will be understood that the section 94e of the browser 94 enables a user to view information in a tag lists format directly without regard to the plant location or physical network in which the associated device is located. Thus, while the same tags list format may be used to view the

data in sections 94a, 94b and 94e, different groupings of the data may be accessed via these different navigational tree sections.

[0078] The browser section 94f may be used to view or browse calibration information including calibration routes, calibration schedules, etc. This section 94f of the browser 94 is associated with a calibration maintenance procedure (that may be stored and executed in, for example, the server 62) that involves testing a device to determine the device's performance and adjusting the device to perform within specification. Calibration history is available for devices which support this calibration management functionality. The Calibration Routes section provides the means for exchanging information between the database 90 and a calibrator. An example calibration routes information screen is illustrated in Fig. 14 which illustrates the information associate with a particular calibration route named Route1 using a tags list format. Routes can be used with either documenting calibrators or with standard test equipment. As will be understood, the user can view the calibration routes that have been defined in the system from the route level in the tree 94f. By selecting a particular route in the tree view 94f, associated devices will be displayed in the object viewer section 95 using a tag list format. Of course, the information actually displayed can be changed via the drop down menu 98 to include, for example, audit trail information (associated with a calibration route), configuration and calibration information associated with a calibration route.

[0079] The Calibration Schedule portion of the tree 94f shows the details of calibration scheduling for devices by their tags, including the location of the device as stored within the plant database 90, the dates for the last calibration and the next scheduled calibration, whether or not the calibration is critical, etc. An example calibration schedule screen is illustrated in Fig. 15 listing devices by tags and based on the next scheduled calibration date/time. A search criteria field 99 may be used to change the calibration information that is provided in the data view on the screen. This search criteria may enable a user to view previous or future scheduled calibrations performed on one or more devices and may enable a user to select a time frame in which to search for the calibration information (such as on or before a particular date, on or after a particular date, between two dates, etc. Additionally, the search criteria 99 may enable a user to search for all calibration events, critical calibration events, non-critical calibration events, etc.

[0080] Additionally, the browser section 94g enables a user to browse previously set up or configured favorite information, which may be any information set up by the user as

information that the user would like to view and is specific to each user (i.e., may change from user to user). This section of the browser 94 provides the user with the ability to save the query results generated based on a specific interest with a specific file name, so that the user can view the same reports at a later time.

[0081] While not shown in detail in Fig. 4, the browser section 94 may also include Help information, Security and Administration access (such a the security assigned for the user and the user's credentials), and licensing verification (which provides a mechanism to limit the number of concurrent users remotely accessing the database 90 across the plant network). Of course, if desired, an options menu, such as that illustrated in Fig. 16, may be set up and configured to specify the display and data acquisition parameters associated with one or more of the data information screens provided above. Of course, this options data may be used by the web modules 92 to determine which and how much data to obtain from the server 62 for display at a particular remote site 63 based on the remote sites user's preferences.

[0082] Additionally, a search engine, which may be accessed from a Search tab in the object browser 94, can search the database 90 based on any desired criteria, such as a tag detail, a manufacturer, a serial number, etc. Results of the search may be displayed on the object viewer area 95. An example of a search engine and search display screen is illustrated in Fig. 17, which illustrates the searching capabilities based on device type, manufacturer, revision, tag name, serial number, supported communication protocol, whether the device is assigned, spare, decommissioned, etc. Of course, any other search screen and searching criteria and any type of suitable search engine may be provided and used to perform the searching of the database 90 via the primary data visualization platform 62.

[0083] As will be understood, the data within the object viewer area 95 may be displayed in any one of a number of formats. The tag list format as illustrated above is one of the most generic formats which displays data based on the tag associated with the device to which the data pertains. This tag list format may be used from the plant locations section 94a of the object browser 94, to give the tag list associated with any particular Area/Unit/Control module/Equipment string, from the Routes node, in which the tags under the particular or selected route are listed, from the search screen or tool, which lists the tags meeting the search criteria and from the physical networks section 94b of the browser 94 which displays the tag list associated with any particular physical hierarchy structure. Generally speaking, from the tags list display format, the user can select one or more tags using the select box

section (such as the select box 97 of Fig. 6) and get further detailed information about audit trail information, configuration details, a configuration summary, calibration test events, etc. associated with the selected tag(s).

[0084] Other viewing formats include the Alert Monitor format which displays information based on the active alerts that are being viewed or whether device polling is being performed and an audit trail format which may display data based on one of the six categories discussed above.

[0085] Thus, the remote data access and viewing methodology discussed above provides ease of use and instant access to the data collected by the primary data collection and visualization platform 62 from one or more remote sites 63 without requiring a full installation of the primary data collection software at the remote site 63. This access allows a user to manage plant assets via a standard web browser such an Internet Explorer by obtaining predetermined types of data in a predetermined viewing format.

[0086] In particular, as discussed above, the remote site access methodology enables the ability to access lists of devices whose historical data is stored in a plant database using a simple navigational tree control, using right and left mouse button selections, the ability to access lists of devices that are organized by physical connection by selecting icons on a simple navigational tree control and the ability to access a search screen to query a primary data collection and visualization platform for devices that may be connected to or have historical information stored in the database of that platform. Still further, the remote site access methodology as described herein provides the ability to access specialized reports for field devices by selecting icons in a simple navigational tree control, the ability to remotely view any devices that are currently in an alert state by selecting icons on a simple navigational tree control. Likewise, this alert viewing window may provide a constantly updating view of any device status change information thereby enabling a live view of the device status from a remote site.

[0087] Still further, from the display showing the lists of devices, the user has the ability to retrieve pages of historical device information (audit trail) related to the field devices that have been selected. Likewise, from the display showing the list of devices at the remote site, the remote user has the ability to make changes to the device information if the remote user is an authorized user. From a display showing the lists of devices, the user also has the ability to obtain access to histories of device information, which is stored as an audit trail, regardless

of whether the devices that are being viewed are conventional (i.e., non-smart) devices, or smart devices (which are communicated to using a digital communication protocol such as HART, Fieldbus or Profibus protocols). Likewise, the user can obtain access to any stored configuration parameters for field devices. The form of the configuration data can be a pre-defined common format or in a format that is specific to the type of device. Still further, the user may obtain access to calibration information and calibration records, which are stored in primary database. Additionally, from the pages of historical device information, the user has the ability to look at specific device records, and see details pertaining to the events stored in the primary database. Within the specific detail screen, the user may have the ability to traverse forwards and backwards in time for devices that have been selected for the summary information. The user also has the ability to input a more specific range of dates for the device information records, and to adjust the list of devices that have been selected as the selection criteria.

[0088] As illustrated with respect to the calibration screens of Figs. 10 and 15, the user will have the ability to retrieve high level summary information of calibration events that have been conducted on field devices. From the summary information, the user will be able to select one or more specific calibration reports, and print those reports on a local printer, if so desired. Likewise, from a simple tree control, a user will be able to retrieve information on calibrations that are overdue or that are due within a specific time period in the future, and print a report of that calibration information.

[0089] As indicated above, the data that may be obtained from the primary data collection and visualization platform 62 may be made up of data from multiple different data sources. To enable easy viewing and access to this data from the different data sources, an integrated navigational tree may be used to integrate this data in the browser both at the primary site 62 and at the remote sites 63. Thus, other navigational tree structures besides those illustrated in Figs. 5-15 may be used in the browser section 94 thereby enabling remote viewing of data from multiple different data sources. Fig. 18 illustrates an example integrated navigational tree 100 constructed to provide access to and viewing of data from three different applications, namely, a maintenance application (AMS), which may be the AMSSUITE intelligent device manager, a power equipment monitoring and diagnostic application (RBM), which may be the AMSSUITE machinery health manager, and a plant efficiency monitoring application (e-fficiency), which may be the AMSSUITE equipment performance monitor, configured according to the source of the data. It will be noted that the integrated

navigational tree 100 includes categories for categorizing the application data from each of the data source applications 60 (Fig. 2) and indications of the entities within the process plant associated with those categories.

[0090] As can be seen, the integrated navigational tree 100 includes a high-level category for each of the different applications (the applications 60 of Fig. 2) directly under the Enterprise (or top level) and sub-categories of data under these high-level categories that are dependent on and, in fact, that mirror the navigational trees of each of the different applications 60. Thus, a folder entitled AMS Plant Structure and the folders or categories 102 thereunder are associated with data from the maintenance or (AMS) application. Likewise, a folder entitled RBM Plant Structure and the folders or categories 104 thereunder are associated with data from the power equipment monitoring or (RBM) application. Still further, a folder entitled e-fficiency Plant Structure and the folders or categories 106 thereunder are associated with data from the efficiency monitoring (e-fficiency) application. Of course, more folders and subsections could be provided in the navigational tree 100 to reflect data from other applications, such as control applications, rotating equipment monitoring applications, etc.

[0091] In Fig. 18, each of the subsections 102, 104 and 106 have sub-folders or items configured in a hierarchy the reflects the hierarchy of the navigational tree of the applications from which the data originated. Thus, the subsection 102 includes folders for Areas (Area 1 is shown), Units, Equipment Modules, and Control Modules because the maintenance application (the AMS application which may be the data collection application used within the primary data collection and visualization platform 62) uses a navigational tree structure with these categories. Furthermore, the data received from the maintenance applications is placed into the sub-categories in the subsection 102 as it is organized within the actual maintenance application. For example, the Control Modules (TT-111, TT-222, etc.) for which data exists are illustrated under the Control Module folder in the subsection 102.

[0092] Similarly, the data associated with the power equipment monitoring is illustrated using the navigational tree structure of the related application, which only includes area designations under which the devices (such as pumps, fans, motors and dryers) are located. As a result, each of the pieces of power equipment for which data is collected in the plant by the power equipment monitoring application is depicted in the subsection 104 under Area 1. Likewise, because the e-fficiency application does not use a navigational tree with the S88

hierarchy categories, the pumps, compressors, heat exchangers, etc. being monitored by this application are merely depicted under the general folder labeled e-fficiency Plant Structure 106 as being related to the logical function of efficiency monitoring. It will be noted that the same equipment, such as Pump #3 may be monitored by different applications and thus be depicted multiple times in the integrated navigational tree structure 100. Furthermore, the same or different data (such as different data collected or generated by different applications) for the same device or other plant entity may be accessible in different locations of the integrated navigational tree 100. Of course, it will be understood that there may be other entities or folders associated with each of the subsections 102, 104 and 106 if other devices are recognized and monitored by the applications associated with these sections. Thus, the actual data, such as device depictions, within any of the subsections 102, 104 and 106 is dependent on the devices or other entities being monitored by the actual applications. Furthermore, the type of data about these devices that may be accessible via the navigational tree 100 is also dependent on the data collected or generated about these devices by the actual applications 60.

[0093] Fig. 19 illustrates another example integrated navigational tree 120 which may be created automatically by the integration application 86 (Fig. 2) from each of the navigational tree structures of the different applications sending data to the primary data collection and visualization platform 62. In this case, the data from the different applications is organized into logical areas such as mechanical equipment 122, field instruments 124 and performance monitoring equipment 126. The data from the different applications pertaining to these different sub-areas is mapped into that sub-area using, for example, a default S88 hierarchy or the hierarchy of the applications from which the data originates. Thus, for example, the mechanical data, which is generally received from the power equipment monitoring application, is mapped using the hierarchy of that application, while the field instrumentation equipment 124 is mapped using the hierarchy of the maintenance or control applications which provide this data which, in this case, happens to be the S88 hierarchy. Likewise, the efficiency data is mapped according to the efficiency application hierarchy. Of course, in this case, the data from different applications may be merged to some extent under the different logical or equipment based headings. Thus, data from control and maintenance applications, such as data related to valves, transmitters, etc. measured by both the control and the maintenance applications may be integrated under the field instrumentation equipment category 124 and the subcategories associated therewith.

[0094] As noted above, the integration application 86 may be used to create a mapping methodology between the integrated navigational tree 83b and the navigational trees 83a of each of the different applications 60. The integration application 86 may perform this mapping automatically or may enable a user to specify the mapping between different components of the navigational trees 83a of the applications 60 and the integrated navigational tree 83b. Fig. 20 illustrates an example screen display 140 that may be presented by the integration application 86 to a user to enable the user to specify a particular type of mapping for each of the different applications that provide data to the primary data collection and visualization platform 62.

[0095] The left-hand side of the screen display 140 of Fig. 20 includes a depiction of the integrated navigational tree 142 used by the primary data collection and visualization platform 62 to enable access to the data from different data sources. It will be noted that this integrated navigational tree 142 uses categories defined by the S88 standard. However, if desired, the user could specify other categories or a different hierarchy for the integrated navigational tree using any desired method, such as renaming the depictions of the folders provided in the tree 142, adding new folders, deleting folders, etc. The right-hand side of the screen display 140 includes depictions of the navigational tree structures associated with and, if necessary, obtained from the different applications within the plant 10. It will be noted that these navigational trees may include depictions of general categories as well as depictions of process entities, such as devices. In Fig. 20, a navigational tree structure 144 for the maintenance application (the AMS application) and a navigational tree structure 146 for a power equipment monitoring application (RBM) are illustrated. Interestingly, the navigational tree 144 of the maintenance application uses the categories of the S88 standard while the navigational tree 146 of the power equipment monitoring application does not.

[0096] In any event, a user may map components of a navigational tree, such as the tree 144, onto the integrated navigational tree 142 by selecting a particular depiction of a component of the tree 144 and dragging it over and dropping it onto the depiction of the component of the tree 142 to which it is to be mapped. Of course, other methods of selecting and specifying relationships between components of the navigational tree may be used as well or instead. Upon doing this, the integration application 86 associates the selected element and any sub-element of the tree 144 which is being dragged with the portion of the integrated tree 142 over which it is dropped. Of course, the user may provide any desired mapping and is not limited to placing, for example, the areas of the maintenance tree 144

onto the areas of the integrated tree 142. Likewise, the user can map the components of the power equipment monitoring tree 144 onto any of the components of the integrated tree 142. Upon selecting or specifying a particular mapping, the integration application 86 stores an indication of the mapping and uses that mapping to integrate data from the application into the database 80 and to enable viewing of that data via the integrated navigational tree 142.

[0097] Fig. 21 illustrates an example integrated tree 150 that may be created by the integration application 86, either automatically or upon a user using the screen display 140 of Fig. 20 to specify the manner of integrating data from the different navigational trees of the different applications 60. As illustrated in Fig. 21, a control module portion or branch 152 of the navigational tree 150 includes devices or other elements from each of a number of different applications including the valves (TT-111, TT-222, etc.) from a maintenance application; fans, pumps, motors, dryers (Recrec Pump #5, Exhaust Fan #1, etc.) from a power equipment monitoring application; and compressors and heat exchangers (Compressor #1, Heat Exchanger #1, etc.) from a plant efficiency monitoring application. Of course, other plant entities from the different applications may be organized together under different sections or sub-sections of the integrated tree 150, such as the areas of the different applications under the Areas section, etc. Of course, a screen similar to the screen 140 of Fig. 20 could have been used to specify that the device data associated with each of these different applications should be integrated together under the control module section of the three 150. Similarly, a screen similar to the screen 140 could be used to indicate that area data from different applications may be integrated together under the area designation of the integrated tree 150, etc.

[0098] Fig. 22 illustrates a further screen display 160 having an integrated navigational tree 162 that may be created by the integration application 86 to integrate data from the different applications 60, and which is accessible via a web communication network. The navigational tree 162 may be associated with or created by a configuration system that makes the data therein available to multiple users of the system via web browsers. The example navigational tree 162 includes a browser configuration section 164 having an asset database folder 166, a data sources folder 168 and a related links folder 170. The asset database folder 166 may store or include data pertaining to one or more assets within the process plant, while the data sources folder 168 may include and store data collected from different data sources within the process plant. The data sources to which the configuration tree 162 of Fig. 22 has access are entitled "Cool," "dasdasd," "fdasdasd," "MDC" and "pppp." The asset database

folder 166 and the data sources folder 168 may collect data from different applications or assets as described above with respect to Fig. 2 and provide that data in different sub-folders in a manner that makes that data available to users having access to the configuration screen display 160 via, for example, a web connection.

[0099] The related links folder 170 may store links, such as web links, to other applications, documentation or systems associated with any of the data or assets within the process plant or associated with any of the data or assets for which data is stored or collected by the navigational tree 162. In particular, the related links folder 170 may store links placed therein by users of the system to enable easy access to other data, other applications, documentation, etc. that may be related in some manner to the data or other information stored in or accessible through the navigational tree 162. Of course, any authorized user or configuration expert may provide links in the navigational tree 162 and these links may be added or deleted at any time.

[0100] When setting up the navigational tree 162 to collect data from different data sources, a user may specify numerous types of data to be collected from the data sources and the amount and frequency of data to be collected from these sources.

[0101] When an integrated navigational tree has been established for the asset optimization database, a user interface program or application, such as the program or application 84 of the Fig. 2 may provide information about the assets associated with the process plant as stored within the asset database or as provided by the different applications to a user at either the primary platform 62 or one of the remote platforms 63 in an integrated and consistent manner to thereby enable the user to view this data or portions thereof in an easy to understand manner. Because there is potentially a large amount of data associated with the different assets, it is important for the user to be able to view and search only the data the user wishes to see or use, as opposed to all of the data at any particular time. However, it is still desirable for the user to be able to view this different data, typically collected by different data sources or about different assets, in a consistent format, no matter what portion of the data the user is viewing. As a result, the interface or display application 84 will use the navigational tree hierarchy to enable the user to view and search only the data of interest. In this manner, information about all or some subset of the assets within the plant, such as where those assets are located, alerts, or event histories associated with those assets may be provided to a user.

However, the user application 84 will use a common and consistent display and searching format for that data, no matter what portion of the data the user is viewing.

[0102] Fig. 23 illustrates an example screen display 200 that may be presented by the user interface application 84 to a user to provide integrated viewing of data from the asset optimization database. Additionally, this screen may be used at the remote sites 63, if so desired. In particular, the screen display 200 includes a navigational tree section 202 having a navigational tree with three major subheadings ("Asset Database," "Data Sources," and "Favorites") and an informational section 204 which provides information about the assets of the selected element within the navigational tree section 202.

[0103] Because, in the example, screen 200 of Fig. 23, the highest category (i.e., "Asset Optimization") associated with the entire database is selected, all of the data from each of the three subcategories is included in the information section 204. However, the information section 204 organizes this data into three tabs entitled "Assets," "Active Alerts" and "Event History" which provide different formats or views of the data stored in the asset database. Because the Assets tab is selected in the screen 200, the informational view 204 provides Assets data for each of the assets in the selected element of the navigational tree 202. In this case, the assets view illustrated in the informational view 204 of Fig. 23 includes information about all of the assets associated with the asset optimization system. In particular, the total number of assets is provided (2743) along with a name, type, health index, description, and location of each of the assets. Essentially, the name is the name provided to the asset (which should be unique within the plant or group of plants for which data is collected) and the health index provides an index or other numerical information about the health of the asset as that health is determined either by the asset itself or within the asset optimization system. The type, description and location information for each asset is also provided. Of course, not all of the assets fit on the same screen and, thus, further screens may be provided to display the asset information, as indicated by the numbers 1, 2, 3, etc. at the bottom of the informational view 204.

[0104] Fig. 24 depicts a screen 206 with an informational view 208 showing the Active Alerts tab for all of the assets within the asset optimization database. As illustrated in Fig. 24, the active alerts are provided in a table with the number of alerts provided at the top of the table (22) and, for each alert, a date/time, asset name, a severity indication (indicating the severity of the alert or type of alert), a description of the alert and a location of the alert

within the process plant. The alerts of course may be provided in any order such as the date/time order, severity order, location order, etc. If desired, the user interface application 84 may provide a field (not shown in Fig. 24) next to each active alert, which may be an alarm or any other type of alert, that enables a user to acknowledge that alarm or other type of alert. Alternatively, the user interface application 84 may provide the user with the ability to acknowledge the alarms and alerts displayed in the information field in any other manner, such as by presenting a pop-up window or display when the user selects a particular alarm or alert and enabling the user to acknowledge the alarm or alert via the pop-up window. When the user acknowledges an alarm or alert, communication software within the user interface application 84 may send an acknowledgement signal, via the communication network 61, to the data collection entity or data source application which created or sent the alarm or alert to thereby acknowledge that alarm or alert. Such an acknowledgement signal may take any of the well known forms now used for acknowledgment signals, but will be encapsulated into a message and sent over the communication network 61 of Fig. 2.

[0105] Similarly, Fig. 25, depicts a screen 210 having an informational view 212 that shows the Event History tab view which provides information, in this case, about the events generated for all of the assets in the asset optimization database. As illustrated in the informational view 212, the event history format includes a table which provides, for each event (as stored in the event history database) a date/time of the event, an asset name associated with the event, the type of event, a description associated with the event, and the location of the event. As will be understood, the events displayed in this view can be any event associated with one or more assets within the process plant, such as a generation of a status or an alert, a change in the configuration of an asset, a synchronization, calibration or other activity occurring within the plant, or any other event which is stored within or collected by, for example, a configuration or other database associated with the process plant. Of course, as with the other tabs, the event history tab information can be organized or tabulated in any desired manner including according to the date/time, the asset, the type of event, the location of the event, or any other desired attribute of the event.

[0106] Fig. 26 illustrates a further screen 216 that provides asset information to a user at a lower level of data integration, i.e., asset information about a subset of the assets associated with the asset optimization database. In particular, the asset database folder of the navigation tree 202 has been expanded to indicate that there are three asset subcategories under the asset database in the form of three areas of the plant from which data is collected. These three

areas are entitled "Northeast Area," "Northwest Area," and "Southwest Area." Because the Northeast Area folder has been selected, an informational view 218 provides the Assets tab view including data from the assets associated with the Northeast Area. As can be seen from Fig. 11, the Northeast Area includes three assets named motor 1, motor 2 and TT-3044C which are each field instruments. Of course, selecting the Active Alerts tab or the Events History tab in the information view 218 would provide the active alerts data or event history data for the assets within the Northeast Area only, as that is the subset of information (i.e., level of data integration) selected in the navigational tree 202. Likewise, selecting the Northwest Area folder or the Southwest Area folder in the navigational tree 202 would provide asset information with respect to those two areas only.

[0107] Of course, the information displayed in Fig. 26 is the information that is actually stored in the asset database even though this information may be collected by different data sources. As a result, the information views of Figs. 23-26 enable a user to view asset information as stored in the asset database.

[0108] Alternatively, the user may view data about the assets according to the manner in which this data is collected, i.e., according to the data source which collects this data. To do so, the user may select the Data Sources folder in the navigational tree 202. When, as illustrated in Fig. 27, the Data Sources folder is selected, the information displayed to a user is organized in the manner associated with the data sources that provide or collect the asset information. Thus, a screen display 220 of Fig. 27 shows the Assets tab view as having data associated with all of the data sources.

[0109] As illustrated in Fig. 27, the navigational tree 202 includes four data sources named AMS Area 1, AMS Area 2, CSI 1 and E-fficiency data sources, which may be the different data sources of Fig. 2 providing data to the asset database. It will be understood, therefore, that selection of the different data sources in the navigational tree 202, such as the CSI 1 data source, will cause the informational view 222 of Fig. 27 to display only asset information associated the selected data source. As an example, Fig. 28 illustrates a screen 224 having the Asset tab view 226 for the AMS Area 1 portion of the data sources, including only the asset information collected the by AMS Area 1 data source. In this case, the Assets tab view 226 includes details about a particular asset named MV-3095. Of course, the asset information about the other assets associated with the AMS Area 1 or assets collected by the AMS in Area 1 data source is also provided herein. Still further, the selection of the Active

Alerts or the Event History tabs will provide the active alerts and the event history details as collected by the AMS Area 1 data source. Furthermore, while the Asset, Active Alerts and Event History tab views of Figs. 27 and 28 provide different data than those same views of Figs. 23-26, these views still display the data in a common or consistent format, which makes it easier for the user to understand the data and to navigate through the data.

[0110] Of course, selection of any other folder or portion of the navigational tree 202 provides the asset information associated with that folder or portion of the navigational tree. Fig. 29 illustrates a display screen 230 in which a favorites folder, which is a folder established by a user to access their favorite information as provided from any of the data sources, is expanded to illustrate the subcategories thereof. In this case, the Favorites folder includes a Maintenance folder, a News folder and a Weather folder. The Maintenance folder includes an AMSweb folder which points to a web page or web pages associated with the AMS application (data source). Because the AMSweb folder is selected, the web page associated therewith is provided in the information view 232. In this manner, links to other web pages or information can be provided to the user in the same screen structure as the asset information stored in the asset database or as the asset information collected by the data sources. In a similar manner, other sources of information such as connections to web sites which provide information useful for the asset optimization system user may be provided in the favorites folder to allow connection to those sources via the asset optimization system or screen.

[0111] As will be understood, the navigational tree 202 of Figs. 23-29 can be used in conjunction with the Assets tab, the Active Alerts tab and the Event History tab or any other data formats to view different data as collected by different data sources and about different assets in a common or consistent manner. As a result, the user can view asset data of any desired type, such as by asset (using the Asset tab), active alert (using the Active Alerts tab) and event history (using the event history tab) in a common and consistent format while simultaneously being able to control the amount or level of integration of data to be included in the view using the navigational tree. A user can view data at a high level of data integration by selecting a higher level folder in the navigational tree (such as asset database folder or data sources folder) and obtain a consistent view of all of the data associated with that high level category. Alternatively, the user can narrow down the amount of data to be viewed and, therefore, the level of data integration, by selecting a lower level folder (and therefore a lower level of data integration) within the navigational tree, such as a subfolder of

the asset database folder or of the data sources folder, but still view the associated data in the common or consistent data format, i.e., the same format as provided for the higher level of data integration. Thus, the user can view the data in the same manner, (using the Assets tab view, the Active Alerts tab view or the Event History tab view) and thereby obtain a consistent view of the data, no matter what level of data integration the user desires to view. This feature make navigation within the asset database easy and understandable for the user.

[0112] It will be understood that the integrated trees described above or an integrated navigational tree of any other form may be used to access information or data about any of the devices or plant entities referred to therein (with the information being accessed being data provided by the different applications within the process plant 10). Of course, the integrated navigational trees described above may also be used to view more information about the entities depicted therein, to determine the source of data for the entities depicted therein, to launch applications for different entities depicted therein, or to perform other activities with respect to that data. Likewise, other data viewing formats may be used as well or in addition to the Assets, Active Alerts and Event History formats disclosed herein.

[0113] As noted above, the integrated navigational trees described herein may be configured in any number of manners to integrate the data from different data sources or applications within the process plant 10 at different levels of integration. Thus, in one case, different sections of the integrated navigational tree are primarily used for or related to the different applications or data sources providing data to the asset optimization database. However, different sections of the integrated navigational tree may be associated with the different logical parts or functions of the plant so that a different section of the tree exists for control, maintenance, rotating equipment, efficiency, etc. functions, or the devices or units associated with and present in different physical areas of the plant can be integrated together in a single section so that rotating equipment (typically measured by maintenance or rotating equipment applications) and valves (typically measured by control and maintenance applications) are placed together in one section or category of the navigational tree. Similarly, area data, unit data, equipment data, etc. from different applications may be integrated together within the same section or subsection of the integrated navigational tree.

[0114] While the embodiment depicted in Fig. 2 hereof illustrates a single server for each of the different applications, it will be understood that more than one server may be provided in the plant 10 for any particular application and that these different servers may all provide

data pertaining to a particular application to the asset optimization server 62 as different branches. Likewise, there may be multiple databases or plants associated with a particular application and the asset optimization server 62 may receive and integrate the data from these different databases in any desired manner.

[0115] While the integration application 86 of the primary data collection and visualization platform 62 and the other applications described herein are preferably implemented in software, they may be implemented in hardware, firmware, etc., and may be implemented by any other processor associated with the process control system 10. Thus, the elements described herein may be implemented in a standard multi-purpose CPU or on specifically designed hardware or firmware such as an application-specific integrated circuit (ASIC) or other hard-wired device as desired. When implemented in software, the software routine may be stored in any computer readable memory such as on a magnetic disk, a laser disk (such as a CD or a DVD) or other storage medium, in a RAM or ROM of a computer or processor, in any database, etc. Likewise, this software may be delivered to a user or a process plant via any known or desired delivery method including, for example, on a computer readable disk or other transportable computer storage mechanism or over a communication channel such as a telephone line, the internet, etc. (which are viewed as being the same as or interchangeable with providing such software via a transportable storage medium).

[0116] Thus, while the present invention has been described with reference to specific examples, which are intended to be illustrative only and not to be limiting of the invention, it will be apparent to those of ordinary skill in the art that changes, additions or deletions may be made to the disclosed embodiments without departing from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A remote data viewing system for use in a process plant having a plurality of data source applications, each of which collects or generates entity data pertaining to one or more different entities within the process plant, the remote data viewing system comprising:

a primary data collection platform adapted to collect the entity data pertaining to the one or more different entities within the process plant from the data source applications;

a database adapted to store the entity data pertaining to the one or more different entities within the process plant collected by the primary data collection platform;

a web server coupled to the primary data collection platform and adapted to provide remote access to the entity data stored in the database at one or more remote platforms; and

a display application stored on a computer readable memory and adapted to be executed on a processor within one of the one or more remote platforms to create a display for the entity data, the display including a navigational tree having a plurality of sections specifying different categories of entity data in the database and a display view, wherein the display application enables a user to select the different ones of the sections of the navigational tree to specify different entity data to be displayed and presents the entity data associated with a selected section of the navigational tree in a predetermined viewing format.

2. The remote data viewing system of claim 1, wherein the predetermined viewing format organizes the entity data based on device tags associated with the entity data.

3. The remote data viewing system of claim 2, wherein the predetermined viewing format includes a display of audit trail data associated with the device tags.

4. The remote data viewing system of claim 2, wherein the predetermined viewing format includes a display of configuration data associated with the device tags.

5. The remote data viewing system of claim 2, wherein the predetermined viewing format includes a display of calibration data associated with the device tags.

6. The remote data viewing system of claim 5, wherein the calibration data includes a result of at least one calibration procedure.

7. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying one or more plant locations associated with the entity data within the process plant.

8. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying one or more physical networks associated with the entity data within the process plant.

9. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying alerts associated with the entity data within the process plant.

10. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying calibration entities associated with the entity data within the process plant.

11. The remote data viewing system of claim 10, wherein the calibration entities include at least one calibration route defined within the process plant.

12. The remote data viewing system of claim 10, wherein the calibration entities include calibration schedule information for at least one device within the process plant.

13. The remote data viewing system of claim 12, wherein the predetermined viewing format includes a search engine that enables searching for calibration schedule data based on a priority of a calibration procedure.

14. The remote data viewing system of claim 12, wherein the predetermined viewing format includes a search engine enabling searching for calibration schedule data based on a time or date associated with a calibration procedure.

15. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying user defined favorite data associated with the entity data within the process plant.

16. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying audit trail events associated with the entity data within the process plant.

17. The remote data viewing system of claim 1, wherein the navigational tree includes a section specifying device tags associated with the entity data within the process plant.

18. The remote data viewing system of claim 1, further including an alert polling application which polls one or more devices within the process plant for alert information and which sends the alert information to the remote platform for presentation via the predetermined viewing format.

19. The remote data viewing system of claim 1, wherein the web server includes a first application that acquires the entity data from the primary data collection platform as XML data and includes a second application that places the XML data into a web page using the predefined viewing format.

20. The remote data viewing system of claim 1, further including a search engine that searches entity data in the database and presents the entity data located in the search according to the predetermined viewing format.

21. The remote data viewing system of claim 20, wherein the search engine includes a display field having search fields specifying parameters associated with the entity data.

22. The remote data viewing system of claim 1, wherein the web server includes an application that acquires event data from the primary data collection platform in response to a request from one of the remote platforms, places the acquired event data into a web page using the predetermined viewing format and sends the web page to the one of the remote platforms.

23. The remote data viewing system of claim 1, wherein the navigational tree includes multiple sections, wherein each of the multiple sections specifies a different category of entity data and wherein each of the multiple sections includes one or more associated predetermined viewing formats used to view the entity data when selected by a user.

24. A method of viewing entity data generated in a process plant having a plurality of data source applications, each of which collects or generates entity data pertaining to one or more different entities within the process plant, the method comprising:

collecting the entity data pertaining to the one or more entities within the process plant at a primary data collection platform;

storing the collected entity data in a database associated with the primary data collection platform;

accessing the database from a remote site geographically separated from the primary data collection platform to obtain at least a portion of the entity data stored in the database;

displaying a navigational tree at the remote site, the navigational tree including a plurality of sections specifying categories of the entity data in the database; and

displaying a display view at the remote site in conjunction with the navigational tree, wherein the display view presents entity data in a predetermined viewing format in response to a selection of one of the sections of the navigational tree.

25. The method of claim 24, wherein accessing the database includes using a web server located at a second site geographically separated from the remote site to access the entity data stored in the database, placing the accessed entity data into a web page in the predetermined viewing format at the web server and sending the web page to the remote site.

26. The method of claim 25, wherein the second site is geographically separated from the primary data collection platform.

27. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree that organizes the entity data based on one or more plant locations within the process plant.

28. The method of claim 24, wherein displaying the display view at the remote site includes presenting entity data in a predetermined viewing format that organizes the entity data based on device tags in response to a selection of a section of the navigational tree.

29. The method of claim 28, wherein the entity data includes audit trail data associated with the device tags.

30. The method of claim 28, wherein the entity data includes configuration data associated with the device tags.

31. The method of claim 28, wherein the entity data includes calibration data associated with the device tags.

32. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree that organizes the entity data based on one or more physical networks associated with the process plant.

33. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree that organizes the entity data based on alerts generated within the process plant.

34. The method of claim 33, wherein displaying the navigational tree includes displaying a section associated with active alerts and wherein displaying the display view includes presenting active alert entity data in a predetermined viewing format in response to a selection of the section associated with the active alerts.

35. The method of claim 24, wherein displaying the navigational tree includes displaying a first section associated with polling for alerts generated within the process plant, further including initiating an alert polling application that polls for alerts within the process plant in response to a selection of the first section of the navigational tree and wherein displaying the display view includes presenting alert data obtained by the alert polling application in a predetermined viewing format in response to the selection of the first section of the navigational tree.

36. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree that organizes the entity data based on calibration events within the process plant.

37. The method of claim 36, wherein the calibration events include at least one calibration route defined within the process plant.

38. The method of claim 36, wherein the calibration events include at least one calibration schedule defined within the process plant.

39. The method of claim 38, wherein displaying the display view includes providing a search engine enabling searching for calibration schedule data based on a priority of a calibration procedure.

40. The method of claim 38, wherein displaying the display view includes providing a search engine enabling searching for calibration schedule data based on a time or a date associated with a calibration procedure.

41. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree associated with audit trail entity data.

42. The method of claim 24, wherein displaying the navigational tree includes displaying a first section of the navigational tree associated with entity data organized by device tags.

43. The method of claim 42, wherein displaying the first section of the navigational tree includes one or more sub-sections associated with device tags organized by one or more of all devices, assigned devices, spare devices and decommissioned devices.

44. The method of claim 24, further including presenting a search engine view at the remote site to enable a user at the remote site to search the entity data in the database and to present the entity data located in a search according to the predetermined viewing format.

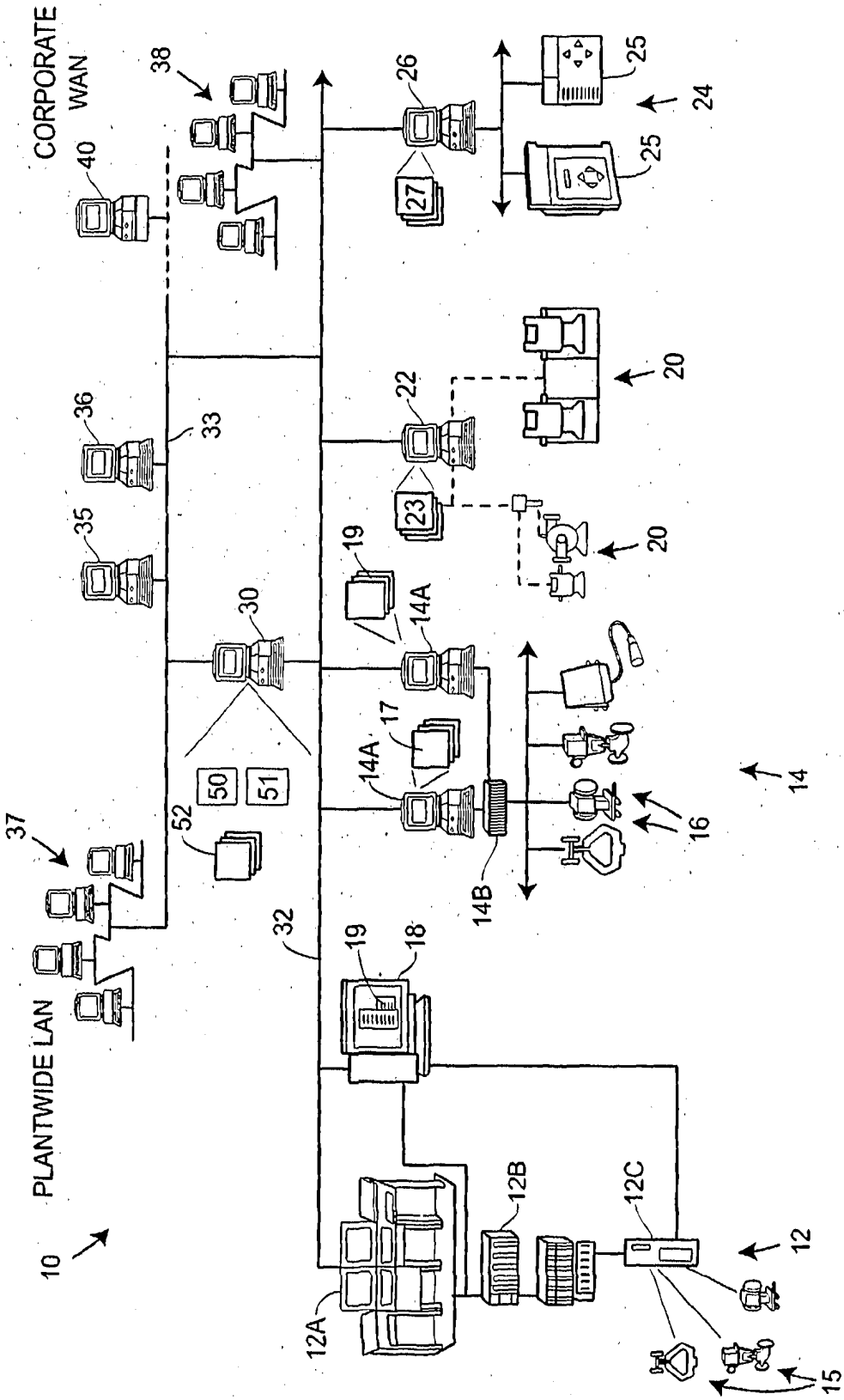
CORPORATE WAN
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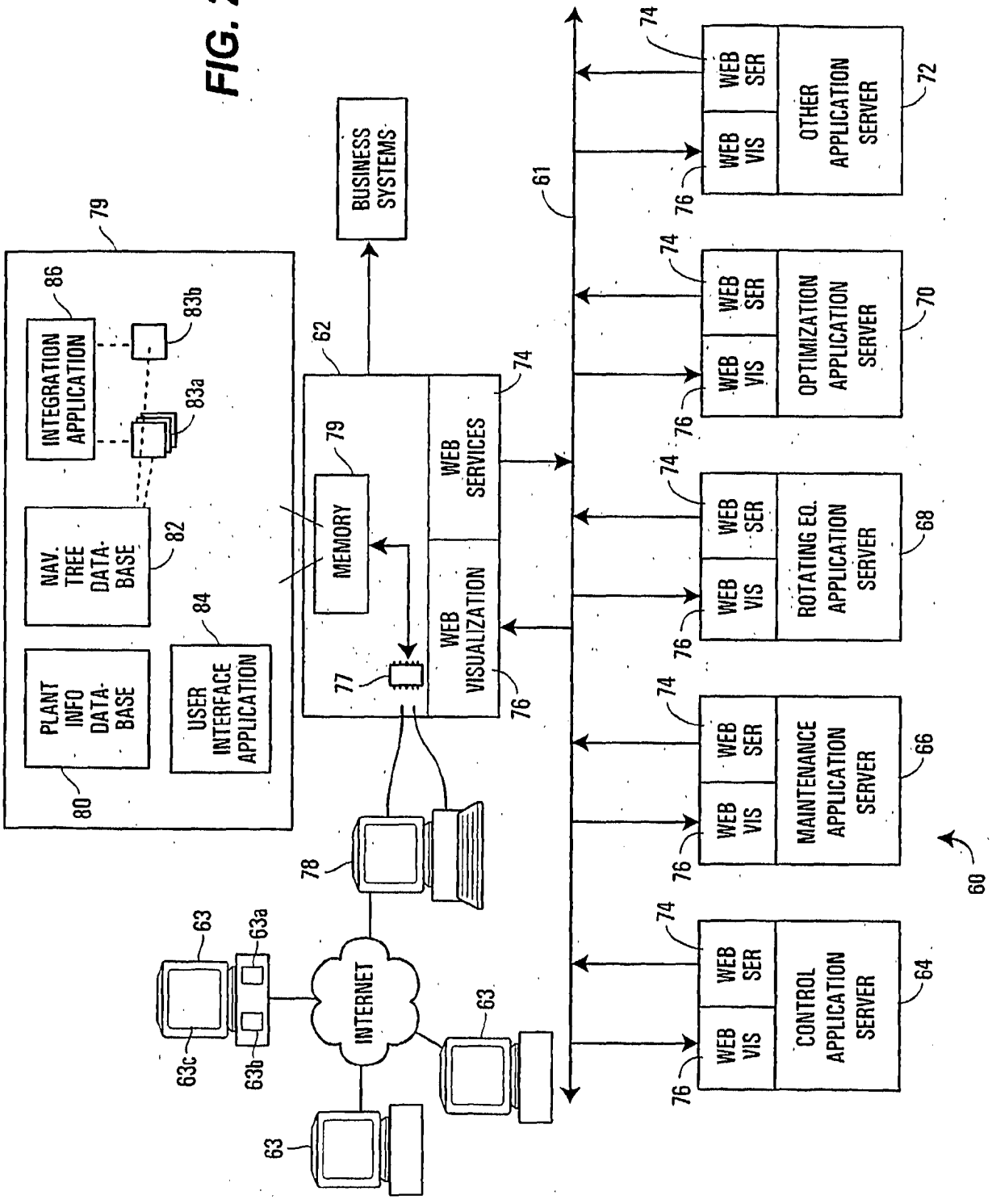
FIG. 1

FIG. 2


BUSINESS SYSTEMS
INTEGRATION APPLICATION
NAV. TREE DATA-BASE
PLANT INFO DATA-BASE
USER INTERFACE APPLICATION
MEMORY
WEB SERVICES
WEB VISUALIZATION
INTERNET
WEB VIS
WEB SER
OTHER APPLICATION SERVER
OPTIMIZATION APPLICATION SERVER
ROTATING EQ. APPLICATION SERVER
MAINTENANCE APPLICATION SERVER
CONTROL APPLICATION SERVER
60
61
62
63
63a
63b
63c
64
66
68
70
72
74
76
77
78
79
80
82
83a
83b
84
86

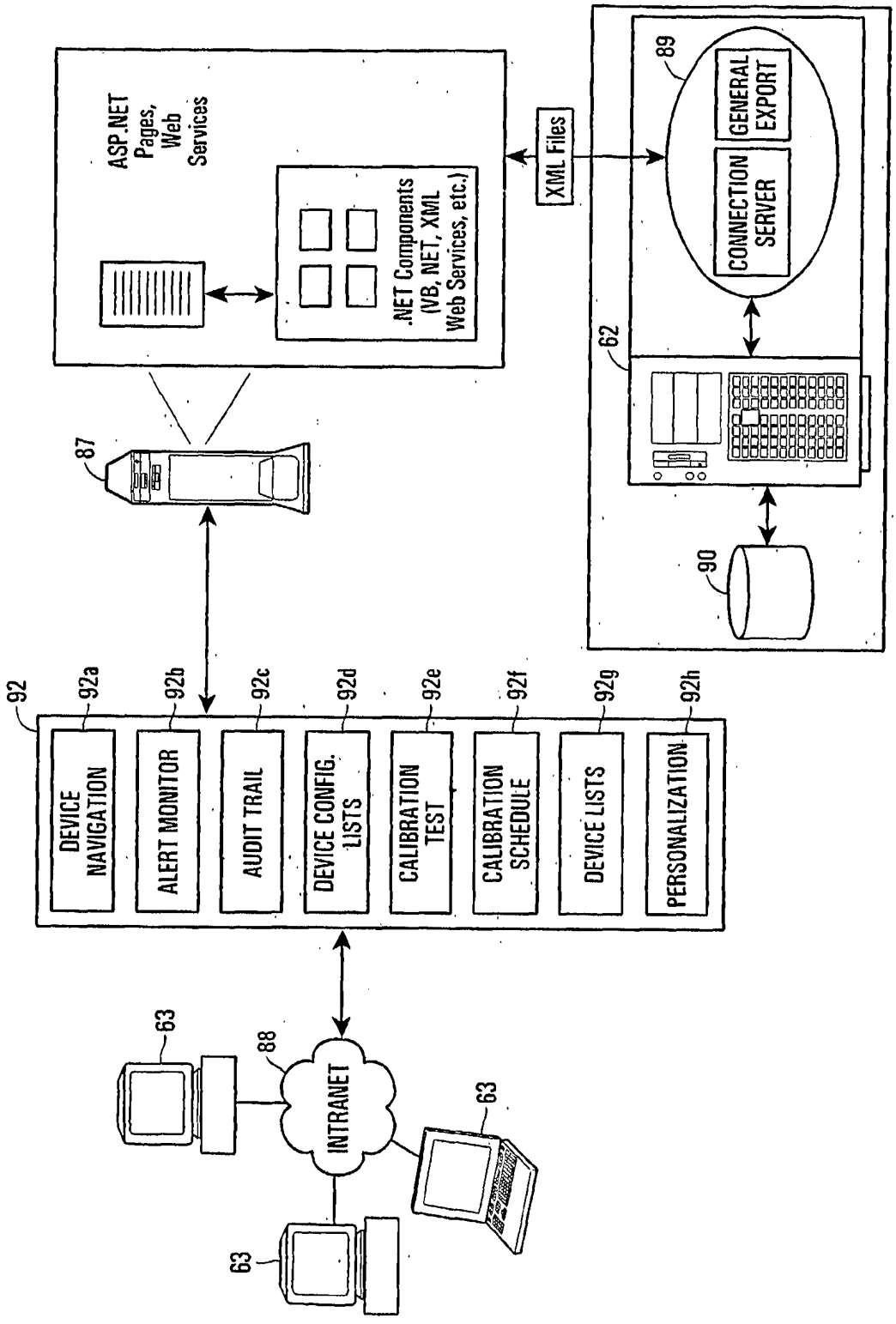

ASP.NET Pages, Web Services
.NET Components (VB, NET, XML Web Services, etc.)
XML Files
GENERAL EXPORT
CONNECTION SERVER
89
62
87
90
92
92a
92b
92c
92d
92e
92f
92g
92h
DEVICE NAVIGATION
ALERT MONITOR
AUDIT TRAIL
DEVICE CONFIG. LISTS
CALIBRATION TEST
CALIBRATION SCHEDULE
DEVICE LISTS
PERSONALIZATION
63
88
INTRANET
63
63

FIG. 3

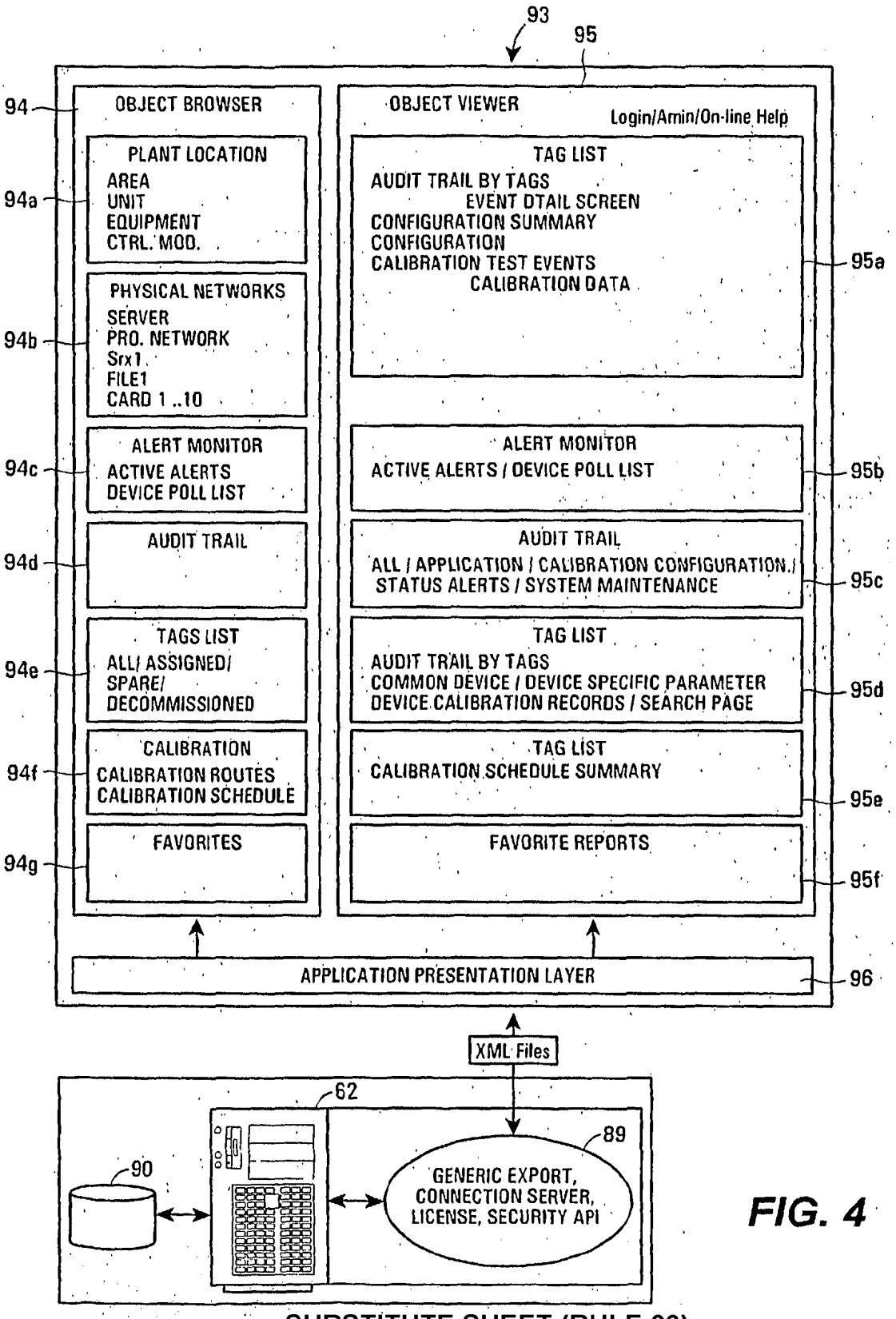

93
95
94
OBJECT BROWSER
OBJECT VIEWER
Login/Amin/On-line Help
PLANT LOCATION
AREA
UNIT
EQUIPMENT
CTRL. MOD.
94a
PHYSICAL NETWORKS
SERVER
PRO. NETWORK
Srx1
FILE1
CARD 1 ..10
94b
TAG LIST
AUDIT TRAIL BY TAGS
EVENT DTAIL SCREEN
CONFIGURATION SUMMARY
CONFIGURATION
CALIBRATION TEST EVENTS
CALIBRATION DATA
95a
ALERT MONITOR
ACTIVE ALERTS
DEVICE POLL LIST
94c
ALERT MONITOR
ACTIVE ALERTS / DEVICE POLL LIST
95b
AUDIT TRAIL
94d
AUDIT TRAIL
ALL / APPLICATION / CALIBRATION CONFIGURATION./
STATUS ALERTS / SYSTEM MAINTENANCE
95c
TAGS LIST
ALL/ ASSIGNED/
SPARE/
DECOMMISSIONED
94e
TAG LIST
AUDIT TRAIL BY TAGS
COMMON DEVICE / DEVICE SPECIFIC PARAMETER
DEVICE CALIBRATION RECORDS / SEARCH PAGE
95d
CALIBRATION
CALIBRATION ROUTES
CALIBRATION SCHEDULE
94f
TAG LIST
CALIBRATION SCHEDULE SUMMARY
95e
FAVORITES
94g
FAVORITE REPORTS
95f
APPLICATION PRESENTATION LAYER
96
XML Files
62
89
90
GENERIC EXPORT,
CONNECTION SERVER,
LICENSE, SECURITY API

FIG. 4

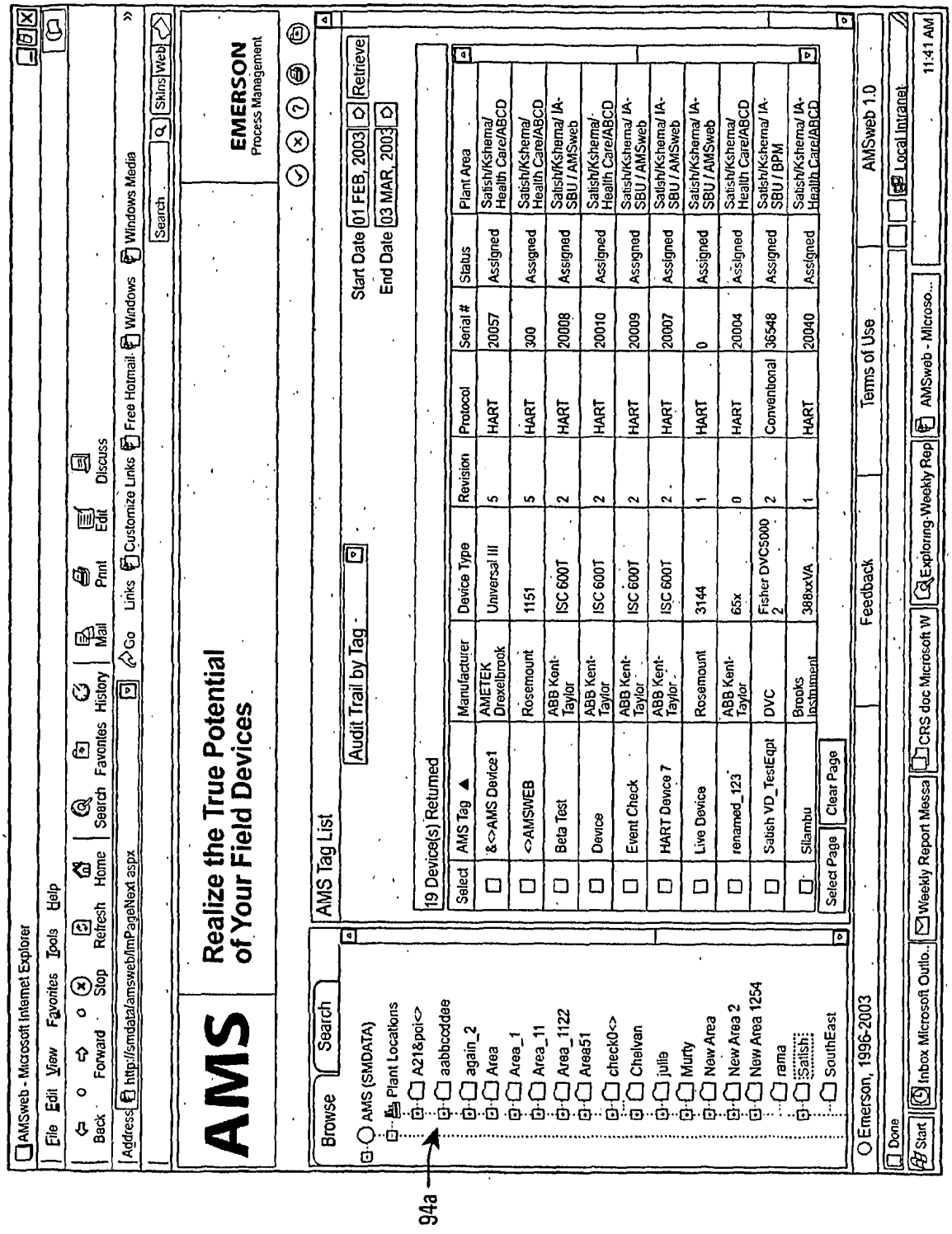

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/ImPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Search Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
AMS Tag List
Audit Trail by Tag
Start Date 01 FEB, 2003 Retrieve
End Date 03 MAR, 2003
19 Device(s) Returned
Select AMS Tag Manufacturer Device Type Revision Protocol Serial # Status Plant Area
&<>AMS Device1 AMETEK Drexelbrook Universal III 5 HART 20057 Assigned Satish/Kshema/ Health Care/ABCD
<>AMSWEB Rosemount 1151 5 HART 300 Assigned Satish/Kshema/ Health Care/ABCD
Beta Test ABB Kent-Taylor ISC 600T 2 HART 20008 Assigned Satish/Kshema/ IA-SBU / AMSweb
Device ABB Kent-Taylor ISC 600T 2 HART 20010 Assigned Satish/Kshema/ Health Care/ABCD
Event Check ABB Kent-Taylor ISC 600T 2 HART 20009 Assigned Satish/Kshema/ IA-SBU / AMSweb
HART Device 7 ABB Kent-Taylor ISC 600T 2 HART 20007 Assigned Satish/Kshema/ IA-SBU / AMSweb
Live Device Rosemount 3144 1 HART 0 Assigned Satish/Kshema/ IA-SBU / AMSweb
renamed_123 ABB Kent-Taylor 65x 0 HART 20004 Assigned Satish/Kshema/ Health Care/ABCD
Satish VD_TestEqpt DVC Fisher DVC5000 2 2 Conventional 36548 Assigned Satish/Kshema/ IA-SBU / BPM
Silambu Brooks Instrument 388xxVA 1 HART 20040 Assigned Satish/Kshema/ IA-Health Care/ABCD
Select Page Clear Page
AMS (SMDATA)
Plant Locations
A21&poi<>
aabbccddee
again_2
Area
Area_1
Area_11
Area_1122
Area51
check0<>
Chelvan
julia
Murty
New Area
New Area 2
New Area 1254
rama
Satish
SouthEast
94a
Feedback
Terms of Use
AMSweb 1.0
Emerson, 1996-2003
Done
Start
Inbox Microsoft Outlo...
Weekly Report Messa
CRS doc Microsoft W
Exploring-Weekly Rep
AMSweb - Microso...
Local Intranet
11:41 AM

FIG. 5

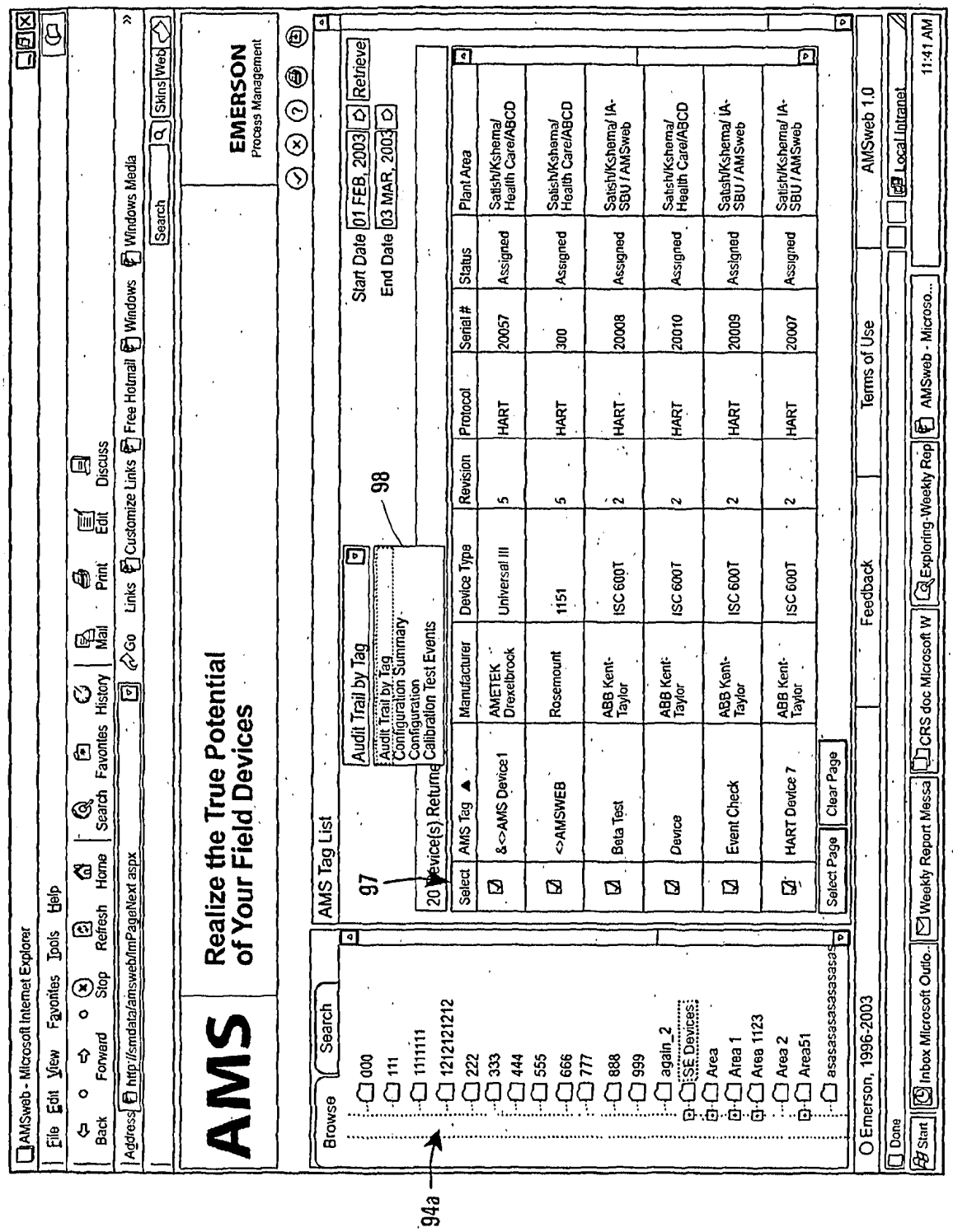

AMSweb - Microsoft Internet Explorer
AMS
Realize the True Potential of Your Field Devices
EMERSON
Process Management
Browse
Search
AMS Tag List
Audit Trail by Tag
Configuration Summary
Configuration
Calibration Test Events
Start Date 01 FEB, 2003
End Date 03 MAR, 2003
Retrieve
20 Device(s) Returned
Select
AMS Tag
Manufacturer
Device Type
Revision
Protocol
Serial #
Status
Plant Area
Select Page
Clear Page
Feedback
Terms of Use
AMSweb 1.0
Emerson, 1996-2003
94a
97
98

FIG. 6

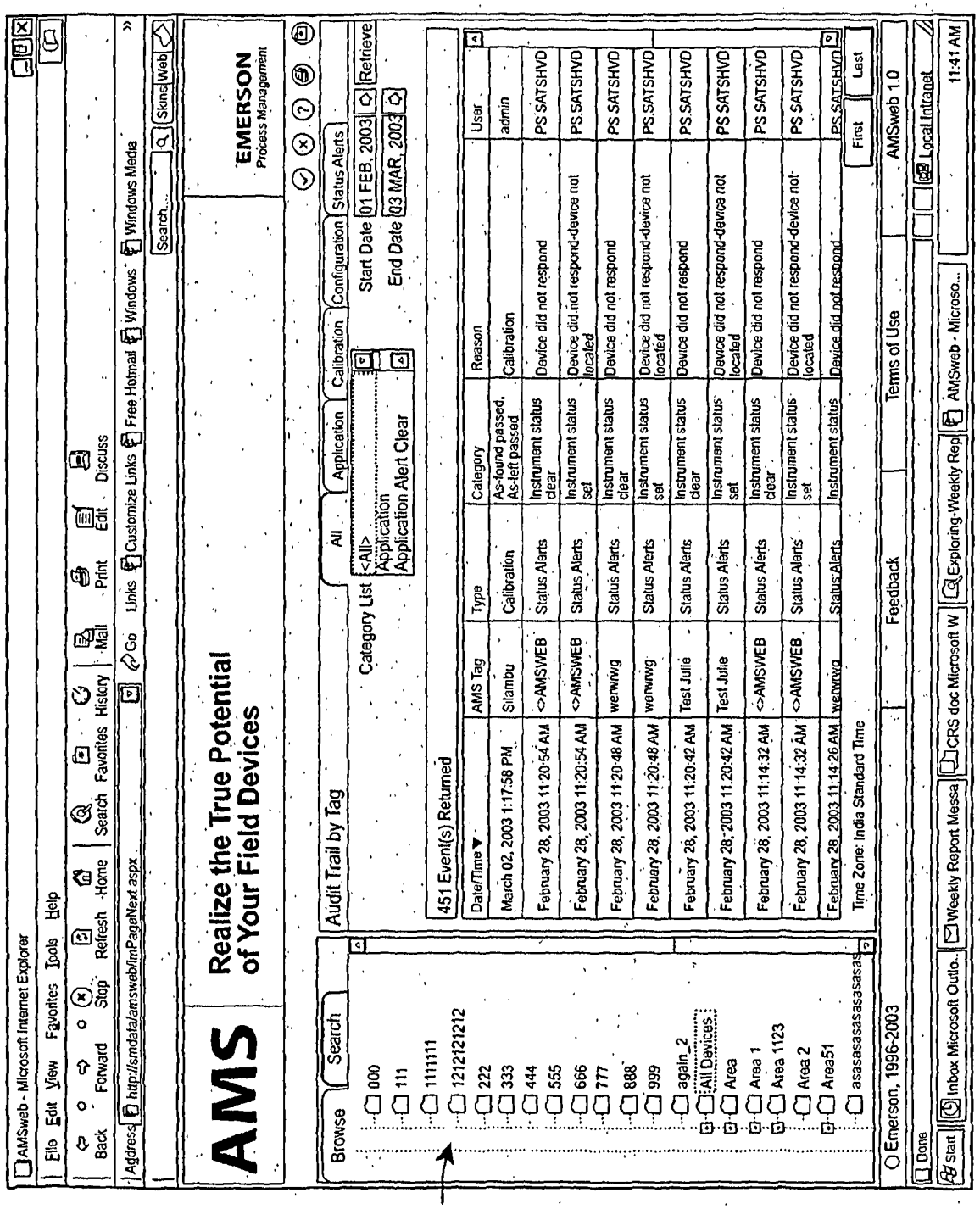

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/InaPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Search... Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
000
111
1111111
1212121212
222
333
444
555
666
777
888
999
again_2
All Devices
Area
Area 1
Area 1123
Area 2
Area51
asasasasasasasasasas
Audit Trail by Tag
Category List
All Application Calibration Configuration Status Alerts
<All>
Application
Application Alert Clear
Start Date 01 FEB, 2003
End Date 03 MAR, 2003
Retrieve
451 Event(s) Returned
Date/Time
AMS Tag
Type
Category
Reason
User
March 02, 2003 1:17:58 PM Silambu Calibration As-found passed, As-left passed Calibration admin
February 28, 2003 11:20:54 AM <>AMSWEB Status Alerts Instrument status clear Device did not respond PS SATSHVD
February 28, 2003 11:20:54 AM <>AMSWEB Status Alerts Instrument status set Device did not respond-device not located PS SATSHVD
February 28, 2003 11:20:48 AM werwrwg Status Alerts Instrument status clear Device did not respond PS SATSHVD
February 28, 2003 11:20:48 AM werwrwg Status Alerts Instrument status set Device did not respond-device not located PS SATSHVD
February 28, 2003 11:20:42 AM Test Julie Status Alerts Instrument status clear Device did not respond PS SATSHVD
February 28, 2003 11:20:42 AM Test Julie Status Alerts Instrument status set Device did not respond-device not located PS SATSHVD
February 28, 2003 11:14:32 AM <>AMSWEB Status Alerts Instrument status clear Device did not respond PS SATSHVD
February 28, 2003 11:14:32 AM <>AMSWEB Status Alerts Instrument status set Device did not respond-device not located PS SATSHVD
February 28, 2003 11:14:26 AM werwrwg Status Alerts Instrument status Device did not respond PS SATSHVD
First Last
Time Zone: India Standard Time
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start
Inbox Microsoft Outlo...
Weekly Report Messa
CRS doc Microsoft W
Exploring-Weekly Rep
AMSweb - Microso...
11:41 AM
94a

FIG. 7

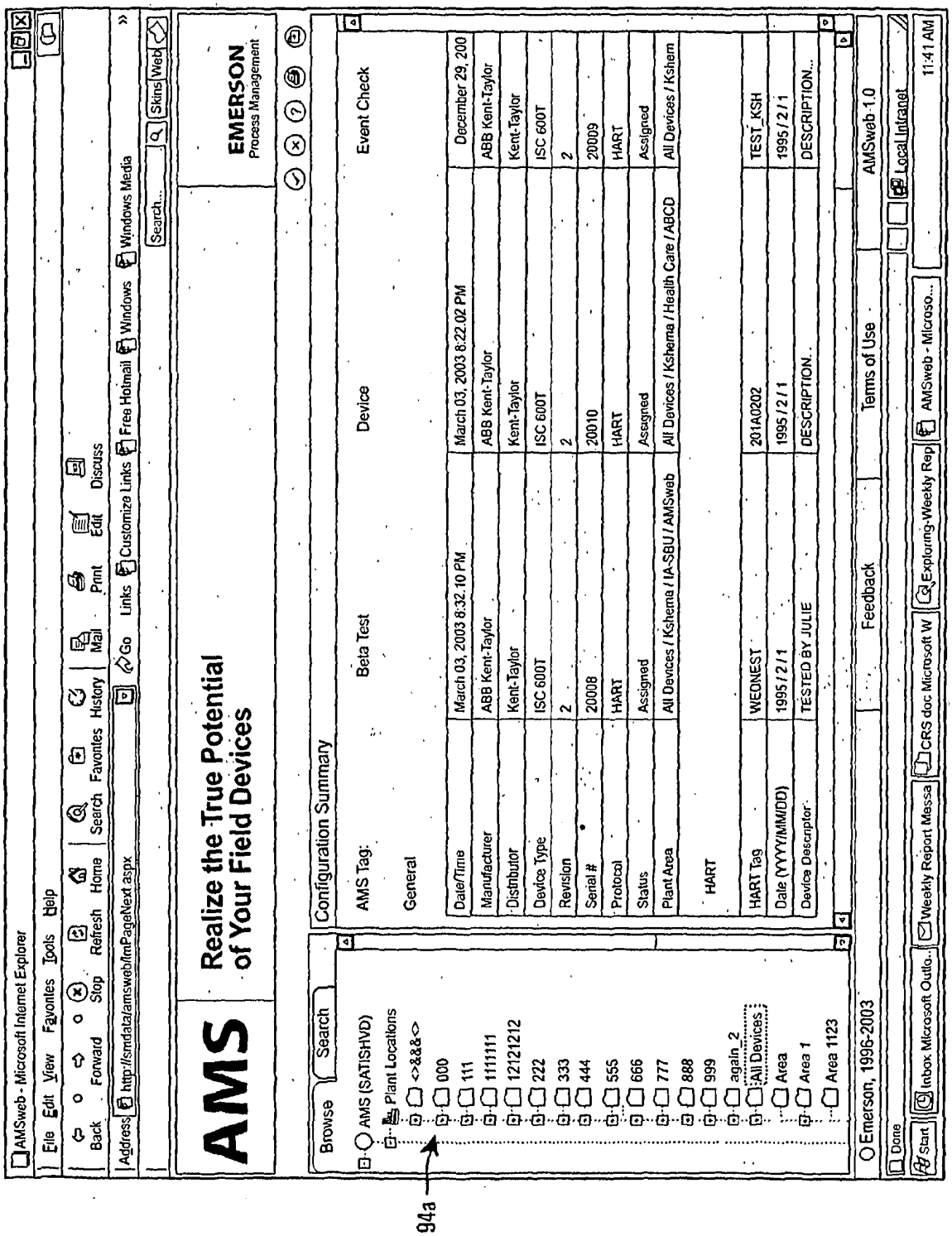

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/frmPageNext.aspx
Go Links Customize Links Free Hotmail Windows Windows Media
Search... Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
AMS (SATISHVD)
Plant Locations
<>&&&<>
000
111
1111111
12121212
222
333
444
555
666
777
888
999
again_2
All Devices
Area
Area 1
Area 1123
94a
Configuration Summary
AMS Tag: Beta Test Device Event Check
General
Date/Time March 03, 2003 8:32:10 PM March 03, 2003 8:22:02 PM December 29, 200
Manufacturer ABB Kent-Taylor ABB Kent-Taylor ABB Kent-Taylor
Distributor Kent-Taylor Kent-Taylor Kent-Taylor
Device Type ISC 600T ISC 600T ISC 600T
Revision 2 2 2
Serial # 20008 20010 20009
Protocol HART HART HART
Status Assigned Assigned Assigned
Plant Area All Devices / Kshema / IA-SBU / AMSweb All Devices / Kshema / Health Care / ABCD All Devices / Kshem
HART
HART Tag WEDNEST 201A0202 TEST_KSH
Date (YYYY/MM/DD) 1995/2/1 1995/2/1 1995/2/1
Device Descriptor TESTED BY JULIE DESCRIPTION... DESCRIPTION...
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start
Inbox Microsoft Outlo...
Weekly Report Messa...
CRS doc Microsoft W...
Exploring-Weekly Rep...
AMSweb - Microso...
11:41 AM

FIG. 8

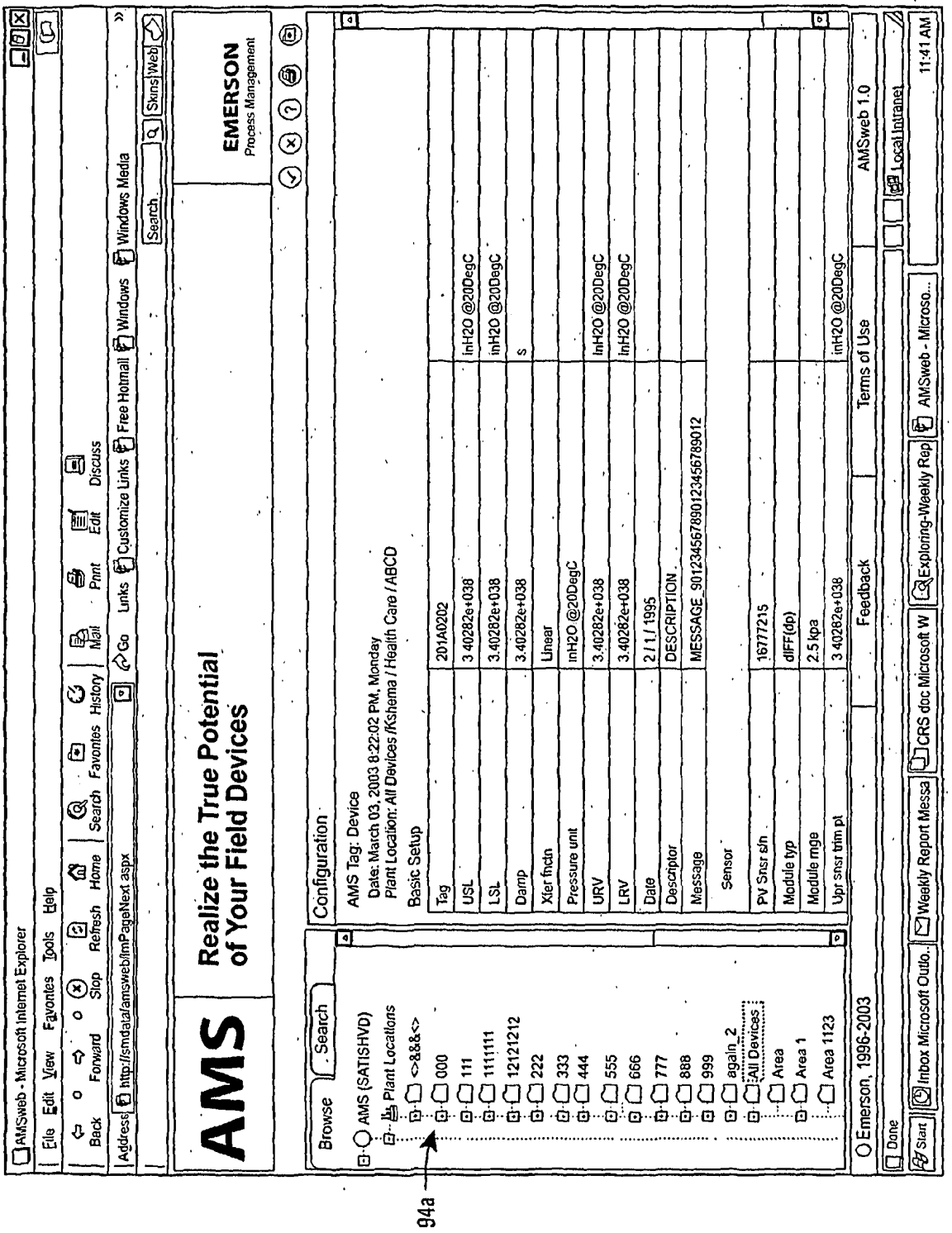

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/frmPageNext.aspx
Go Links Customize Links Free Hotmail Windows Windows Media
Search Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
Configuration
AMS Tag: Device
Date: March 03, 2003 8:22:02 PM, Monday
Plant Location: All Devices /KShema / Health Care / ABCD
Basic Setup
AMS (SATISHVD)
Plant Locations
<>&&&<>
000
111
1111111
12121212
222
333
444
555
666
777
888
999
again_2
All Devices
Area
Area 1
Area 1123
Tag 201A0202
USL 3.40282e+038 inH2O @20DegC
LSL 3.40282e+038 inH2O @20DegC
Damp 3.40282e+038 s
Xfer fnctn Linear
Pressure unit inH2O @20DegC
URV 3.40282e+038 inH2O @20DegC
LRV 3.40282e+038 inH2O @20DegC
Date 2 / 1 / 1995
Descriptor DESCRIPTION
Message MESSAGE_90123456789012345678901 2
Sensor
PV Snsr s/n 16777215
Module typ dIFF(dp)
Module mge 2.5 kpa
Upr snsr trim pt 3.40282e+038 inH2O @20DegC
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Start
Inbox Microsoft Outlo...
Weekly Report Messa
CRS doc Microsoft W
Exploring-Weekly Rep
AMSweb - Microso...
Local Intranet
11:41 AM
94a

FIG. 9

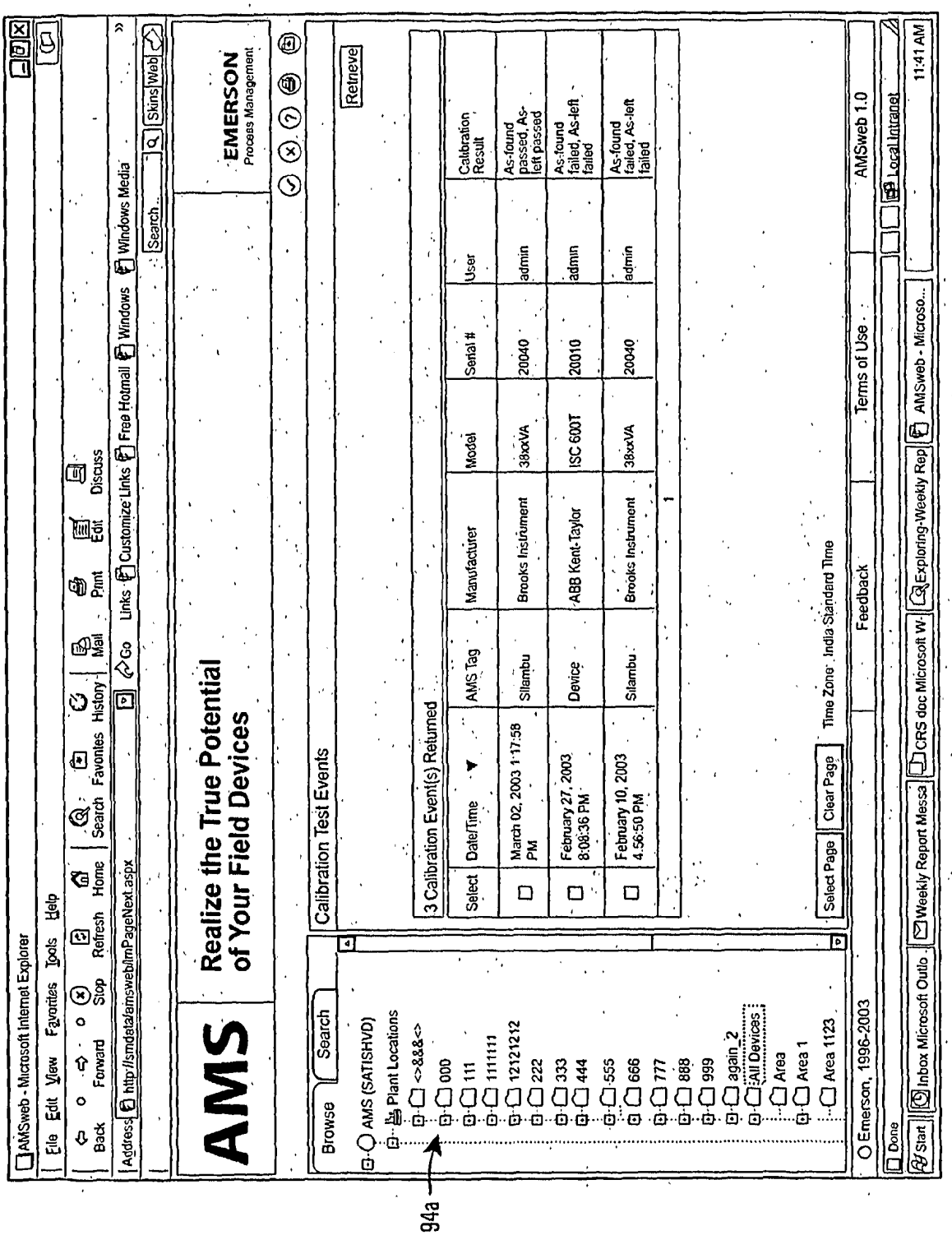

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/mPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Search Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
AMS (SATISHVD)
Plant Locations
<>&&&<>
000
111
1111111
12121212
222
333
444
555
666
777
888
999
again_2
All Devices
Area
Area 1
Area 1123
Calibration Test Events
Retreve
3 Calibration Event(s) Returned
Select Date/Time AMS Tag Manufacturer Model Serial # User Calibration Result
March 02, 2003 1:17:58 PM Silambu Brooks Instrument 38xxVA 20040 admin As-found passed, As-left passed
February 27, 2003 8:08:36 PM Device ABB Kent-Taylor ISC 600T 20010 admin As-found failed, As-left failed
February 10, 2003 4:56:50 PM Silambu Brooks Instrument 38xxVA 20040 admin As-found failed, As-left failed
1
Select Page Clear Page Time Zone : India Standard Time
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start Inbox Microsoft Outlo Weekly Report Messa CRS doc Microsoft W Exploring-Weekly Rep AMSweb - Microso...
11:41 AM
94a

FIG. 10

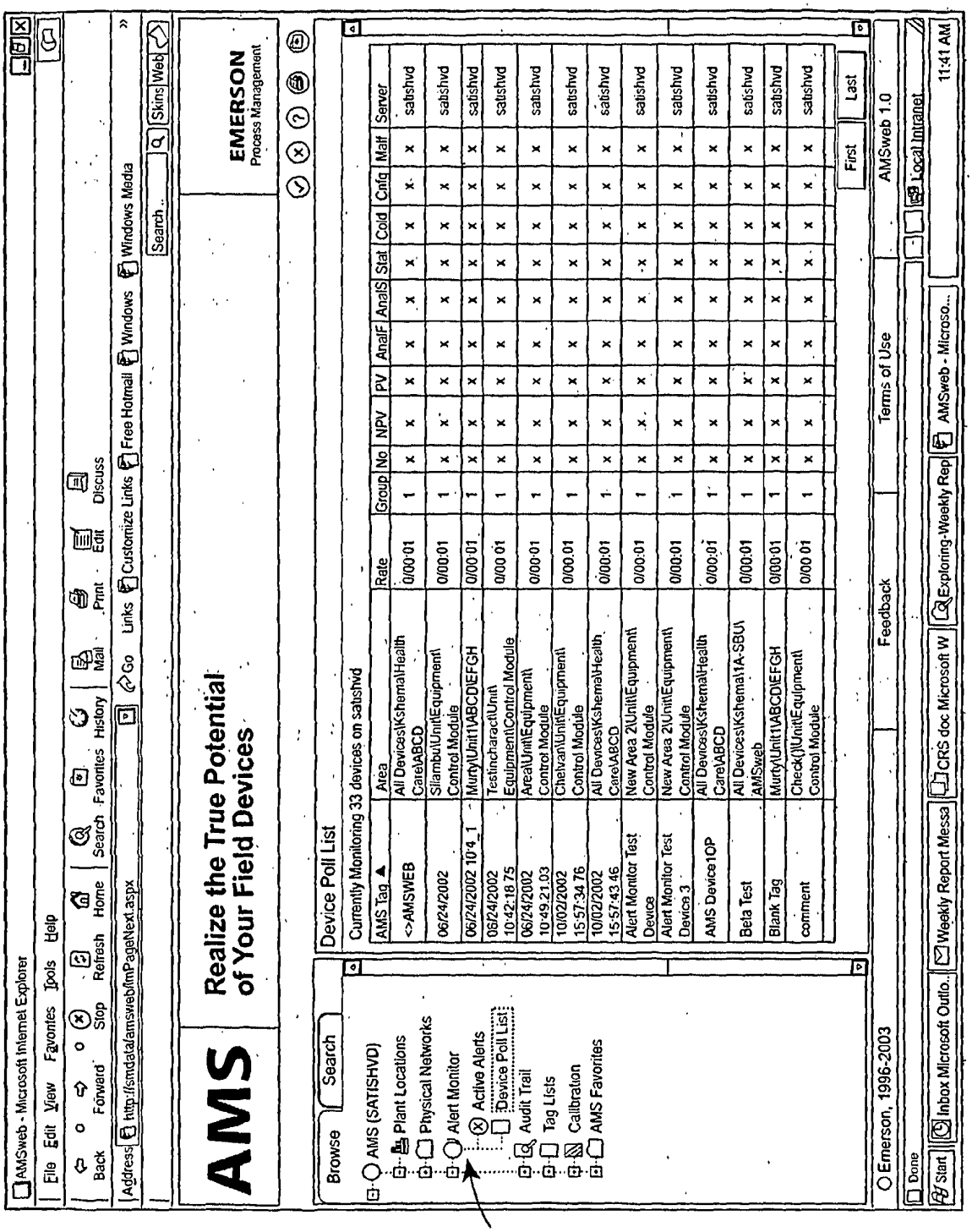

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/fmPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
AMS (SATISHVD)
Plant Locations
Physical Networks
Alert Monitor
Active Alerts
Device Poll List
Audit Trail
Tag Lists
Calibration
AMS Favorites
94c
Device Poll List
Currently Monitoring 33 devices on satishvd
AMS Tag | Area | Rate | Group | No | NPV | PV | AnalF | AnalS | Stat | Cold | Cnfg | Malf | Server
<>AMSWEB | All Devices\KshemaHealth Care\ABCD | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
06/24/2002 | Sitambu\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
06/24/2002 10:4_1 | Murty\Unit1\ABCDIEFGH | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
06/24/2002 10:42:18 75 | TestIncharact\Unit\ Equipment\Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
06/24/2002 10:49:21 03 | Area\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
10/02/2002 15:57:34 76 | Chelvan\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
10/02/2002 15:57:43 46 | All Devices\KshemaHealth Care\ABCD | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
Alert Monitor Test Device | New Area 2\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
Alert Monitor Test Device 3 | New Area 2\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
AMS Device1OP | All Devices\KshemaHealth Care\ABCD | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
Beta Test | All Devices\Kshema1A-SBU\ AMSweb | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
Blank Tag | Murty\Unit1\ABCDIEFGH | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
comment | Check()\Unit\Equipment\ Control Module | 0/00:01 | 1 | x | x | x | x | x | x | x | x | x | satishvd
First Last
Feedback Terms of Use AMSweb 1.0
Emerson, 1996-2003
Done
Local Intranet
Start Inbox Microsoft Outlo... Weekly Report Messa CRS doc Microsoft W Exploring-Weekly Rep AMSweb - Microso...
11:41 AM

FIG. 11

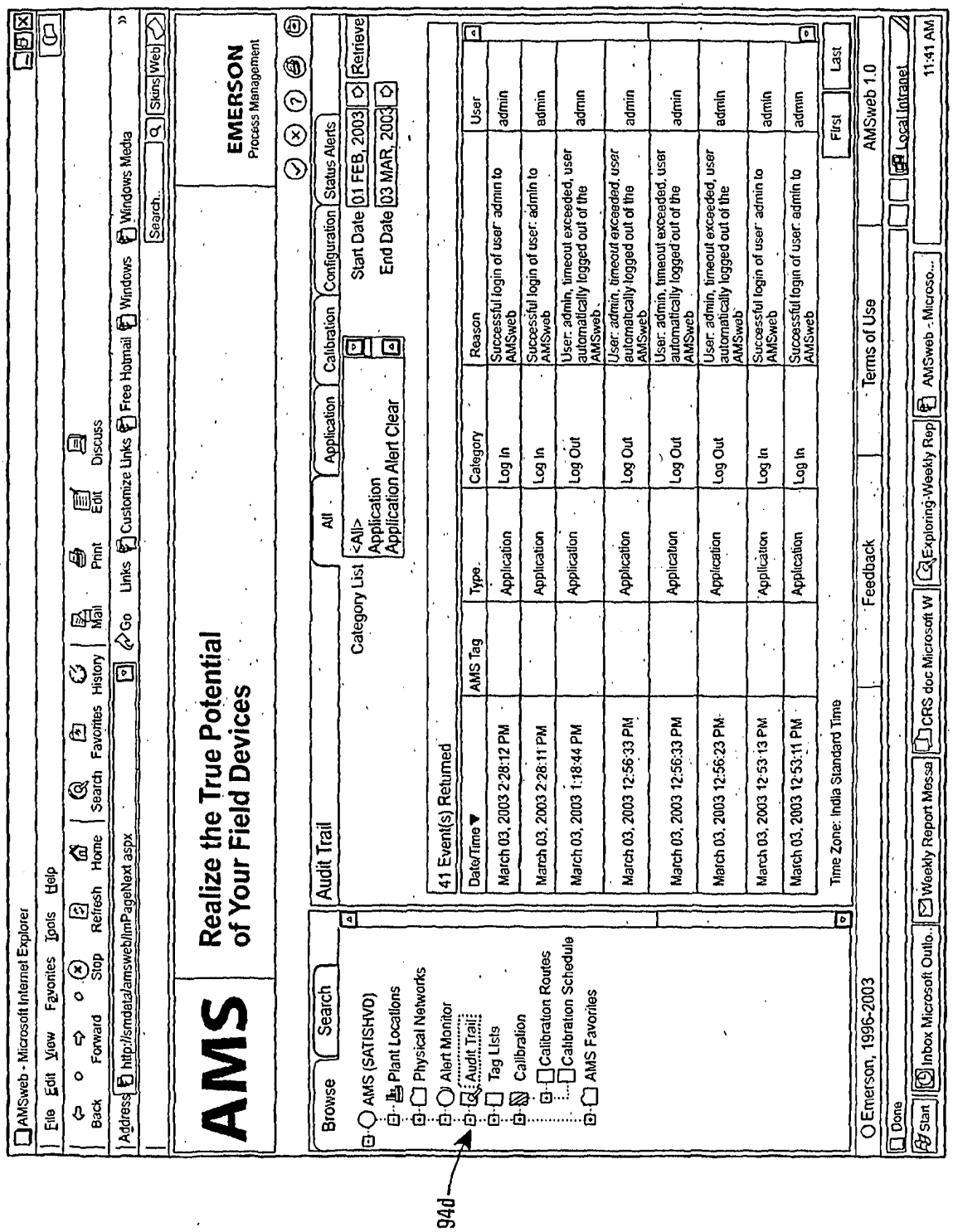

AMSweb - Microsoft Internet Explorer
AMS
Realize the True Potential of Your Field Devices
EMERSON
Process Management
Browse
Search
AMS (SATISHVD)
Plant Locations
Physical Networks
Alert Monitor
Audit Trail
Tag Lists
Calibration
Calibration Routes
Calibration Schedule
AMS Favorites
Audit Trail
Category List
All
Application
Calibration
Configuration
Status Alerts
Start Date 01 FEB, 2003
End Date 03 MAR, 2003
Retrieve
41 Event(s) Returned
Date/Time
AMS Tag
Type
Category
Reason
User
March 03, 2003 2:28:12 PM
Application
Log In
Successful login of user: admin to AMSweb
admin
March 03, 2003 2:28:11 PM
Application
Log In
Successful login of user: admin to AMSweb
admin
March 03, 2003 1:18:44 PM
Application
Log Out
User: admin, timeout exceeded, user automatically logged out of the AMSweb.
admin
March 03, 2003 12:56:33 PM
Application
Log Out
User: admin, timeout exceeded, user automatically logged out of the AMSweb
admin
March 03, 2003 12:56:33 PM
Application
Log Out
User: admin, timeout exceeded, user automatically logged out of the AMSweb
admin
March 03, 2003 12:56:23 PM
Application
Log Out
User: admin, timeout exceeded, user automatically logged out of the AMSweb
admin
March 03, 2003 12:53:13 PM
Application
Log In
Successful login of user: admin to AMSweb
admin
March 03, 2003 12:53:11 PM
Application
Log In
Successful login of user: admin to AMSweb
admin
Time Zone: India Standard Time
First
Last
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
11:41 AM
94d

FIG. 12

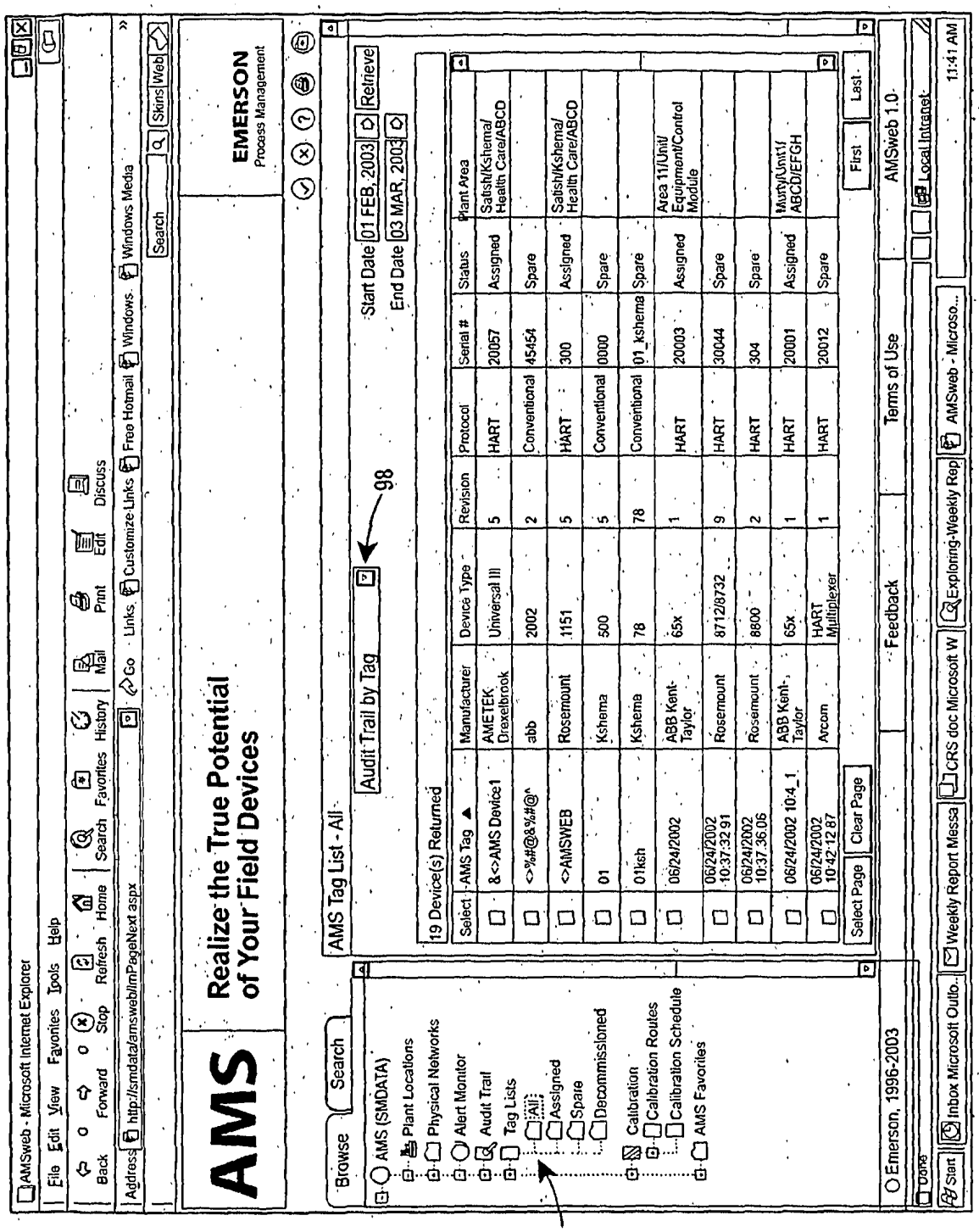

AMSweb - Microsoft Internet Explorer
AMS
Realize the True Potential of Your Field Devices
EMERSON
Process Management
Browse
Search
AMS (SMDATA)
Plant Locations
Physical Networks
Alert Monitor
Audit Trail
Tag Lists
All
Assigned
Spare
Decommissioned
Calibration
Calibration Routes
Calibration Schedule
AMS Favorites
AMS Tag List - All
Audit Trail by Tag
98
Start Date 01 FEB, 2003
End Date 03 MAR, 2003
Retrieve
19 Device(s) Returned
Select
AMS Tag
Manufacturer
Device Type
Revision
Protocol
Serial #
Status
Plant Area
&<>AMS Device1
AMETEK Drexelbrook
Universal III
5
HART
20057
Assigned
Satish/Kshema/Health Care/ABCD
<>%#@&%#@^
abb
2002
2
Conventional
45454
Spare
<>AMSWEB
Rosemount
1151
5
HART
300
Assigned
Satish/Kshema/Health Care/ABCD
01
Kshema
500
5
Conventional
0000
Spare
01ksh
Kshema
78
78
Conventional
01_kshema
Spare
06/24/2002
ABB Kent-Taylor
65x
1
HART
20003
Assigned
Area 11/Unit/Equipment/Control Module
06/24/2002 10:37:32 91
Rosemount
8712/8732
9
HART
30044
Spare
06/24/2002 10:37:36 06
Rosemount
8800
2
HART
304
Spare
06/24/2002 10:4_1
ABB Kent-Taylor
65x
1
HART
20001
Assigned
Murty/Unit1/ABCD/EFGH
06/24/2002 10:42:12 87
Arcom
HART Multiplexer
1
HART
20012
Spare
Select Page
Clear Page
First
Last
94e
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start
Inbox Microsoft Outlo...
Weekly Report Messa...
CRS doc Microsoft W...
Exploring-Weekly Rep...
AMSweb - Microso...
11:41 AM

FIG. 13

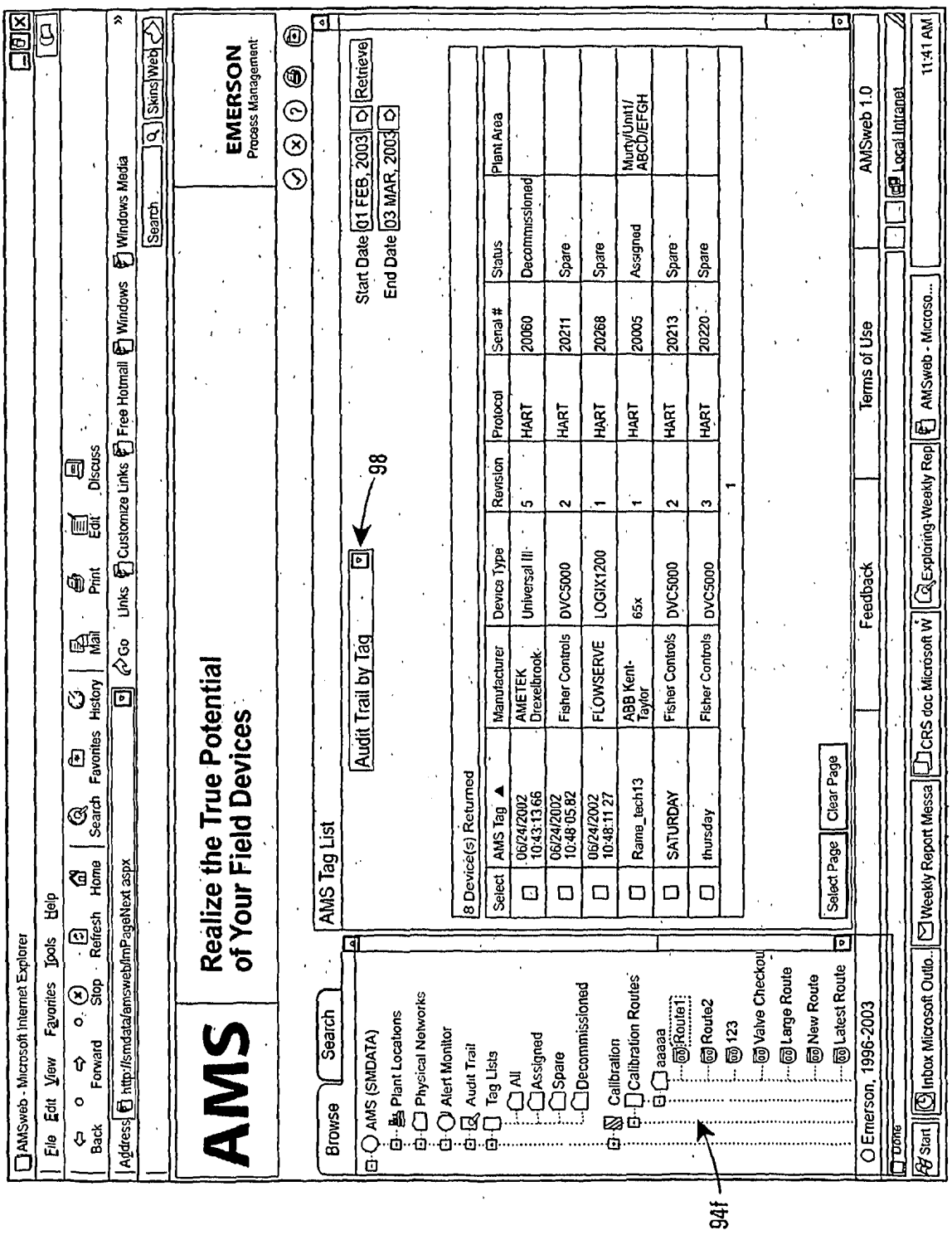
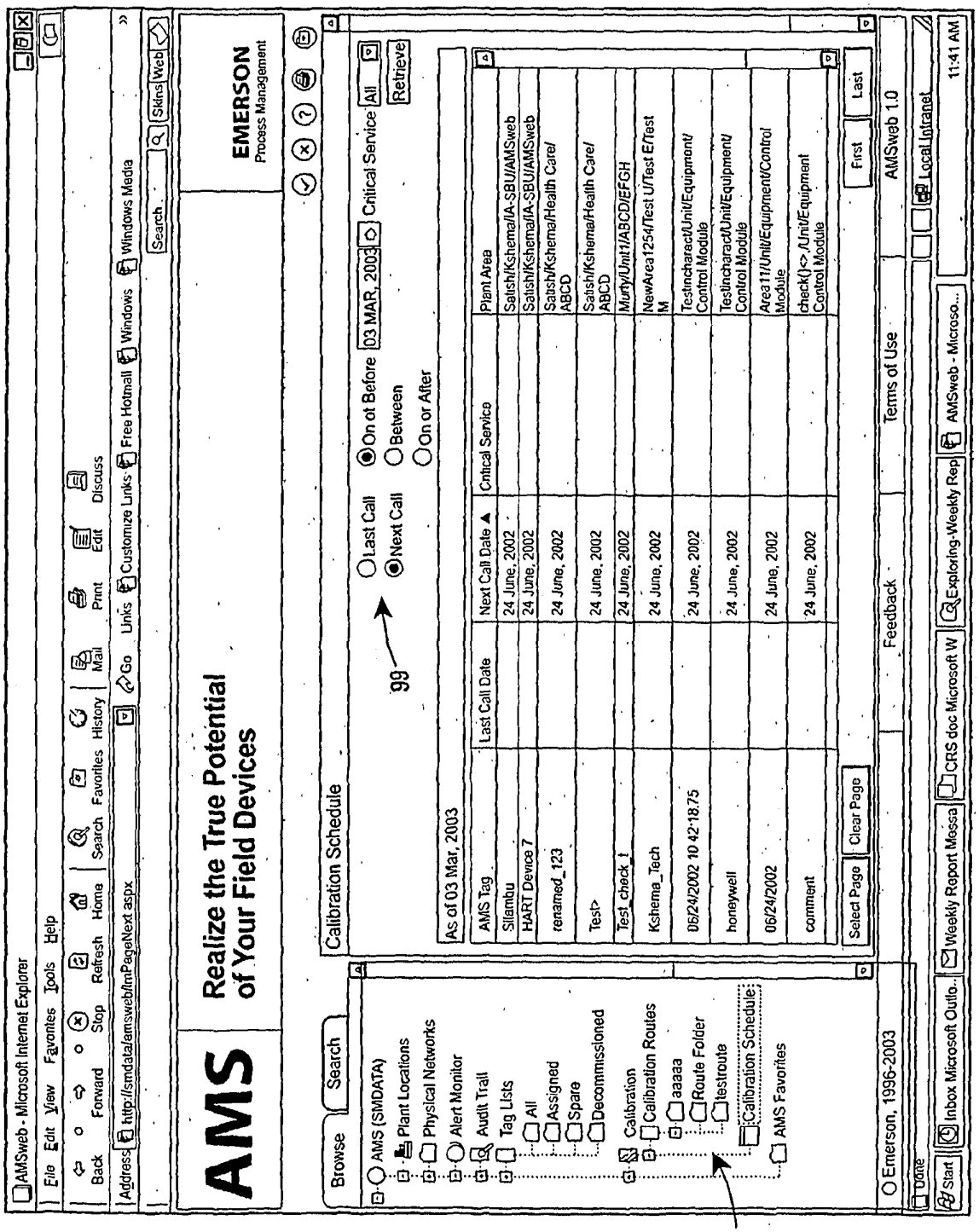

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/ImPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Search Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON Process Management
Browse Search
AMS Tag List
Audit Trail by Tag
98
Start Date 01 FEB 2003 Retrieve
End Date 03 MAR 2003
8 Device(s) Returned
Select AMS Tag Manufacturer Device Type Revision Protocol Serial # Status Plant Area
06/24/2002 10:43:13.66 AMETEK Drexelbrook Universal III 5 HART 20060 Decommissioned
06/24/2002 10:48:05.82 Fisher Controls DVC5000 2 HART 20211 Spare
06/24/2002 10:48:11.27 FLOWSERVE LOGIX1200 1 HART 20268 Spare
Rama_tech13 ABB Kent-Taylor 65x 1 HART 20005 Assigned Murty/Unit1/ ABCD/EFGH
SATURDAY Fisher Controls DVC5000 2 HART 20213 Spare
thursday Fisher Controls DVC5000 3 HART 20220 Spare
1
Select Page Clear Page
AMS (SMDATA)
Plant Locations
Physical Networks
Alert Monitor
Audit Trail
Tag Lists
All
Assigned
Spare
Decommissioned
Calibration
Calibration Routes
aaaaa
Route1
Route2
123
Valve Checkou
Large Route
New Route
Latest Route
94f
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start
Inbox Microsoft Outlo...
Weekly Report Messa
CRS doc Microsoft W
Exploring-Weekly Rep
AMSweb - Microso...
11:41 AM

FIG. 14


AMSweb - Microsoft Internet Explorer
AMS
Realize the True Potential of Your Field Devices
EMERSON
Process Management
Browse
Search
Calibration Schedule
99
Last Call
Next Call
On or Before
Between
On or After
03 MAR, 2003
Critical Service
All
Retrieve
As of 03 Mar, 2003
AMS Tag
Last Call Date
Next Call Date
Critical Service
Plant Area
Select Page
Clear Page
First
Last
Feedback
Terms of Use
AMSweb 1.0
Emerson, 1996-2003
94f
FIG. 15

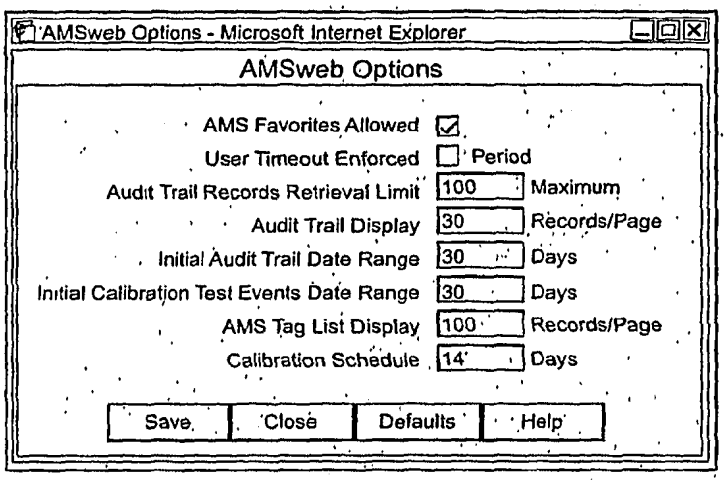

AMSweb Options - Microsoft Internet Explorer
AMSweb Options
AMS Favorites Allowed
User Timeout Enforced
Period
Audit Trail Records Retrieval Limit
100
Maximum
Audit Trail Display
30
Records/Page
Initial Audit Trail Date Range
30
Days
Initial Calibration Test Events Date Range
30
Days
AMS Tag List Display
100
Records/Page
Calibration Schedule
14
Days
Save
Close
Defaults
Help

FIG. 16

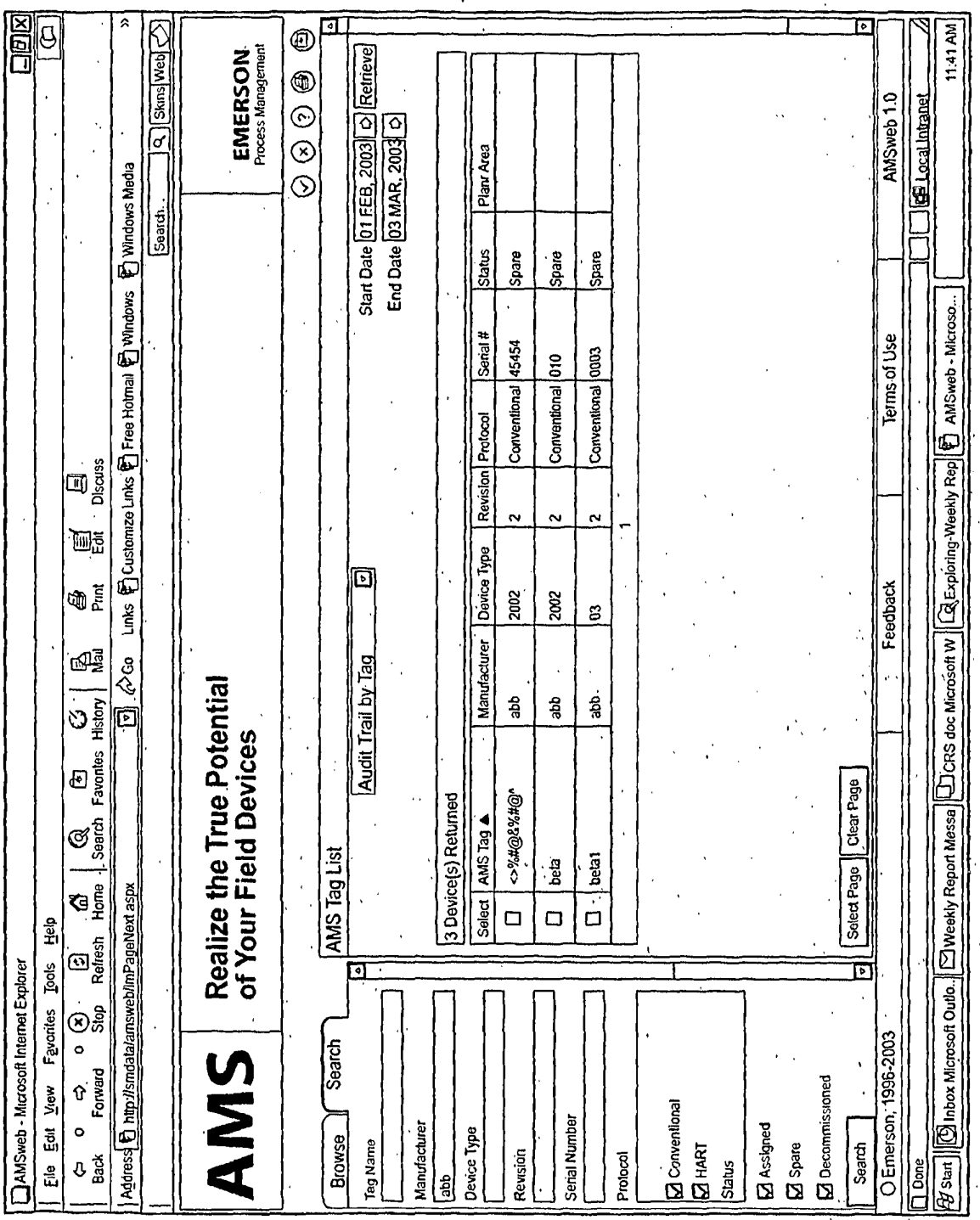

AMSweb - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://smdata/amsweb/imPageNext.aspx
Links Customize Links Free Hotmail Windows Windows Media
Search... Skins Web
AMS
Realize the True Potential of Your Field Devices
EMERSON. Process Management
Browse Search
Tag Name
Manufacturer
abb
Device Type
Revision
Serial Number
Protocol
Conventional
HART
Status
Assigned
Spare
Decommissioned
Search
AMS Tag List
Audit Trail by Tag
Start Date 01 FEB, 2003 Retrieve
End Date 03 MAR, 2003
3 Device(s) Returned
Select AMS Tag Manufacturer Device Type Revision Protocol Serial # Status Plant Area
<>%#@&%#@* abb 2002 2 Conventional 45454 Spare
beta abb 2002 2 Conventional 010 Spare
beta1 abb 03 2 Conventional 0003 Spare
1
Select Page Clear Page
Emerson, 1996-2003
Feedback
Terms of Use
AMSweb 1.0
Done
Local Intranet
Start Inbox Microsoft Outlo... Weekly Report Messa CRS doc Microsoft W Exploring-Weekly Rep AMSweb - Microso...
11:41 AM

FIG. 17

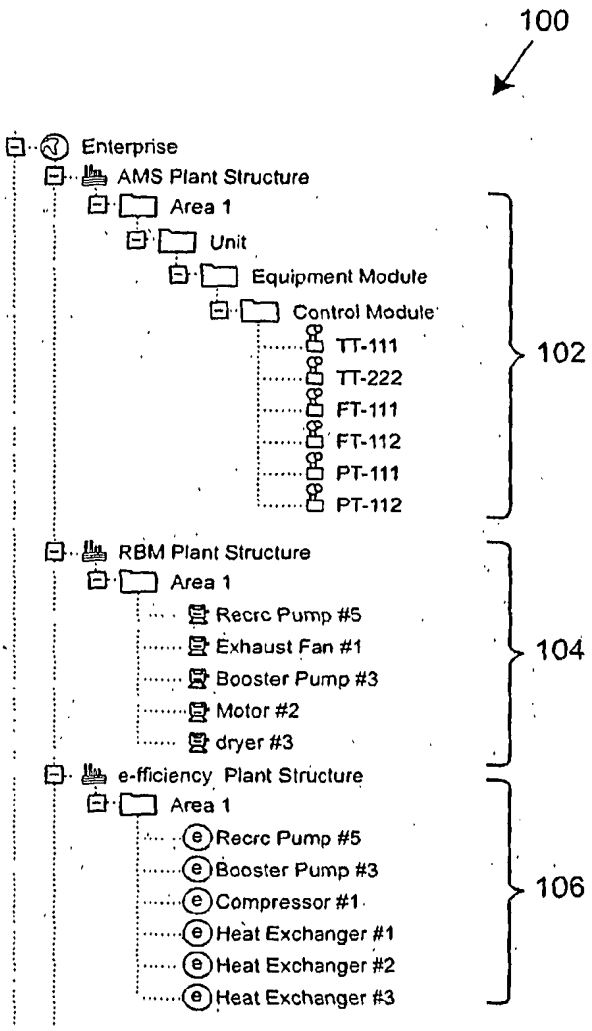

100
Enterprise
AMS Plant Structure
Area 1
Unit
Equipment Module
Control Module
TT-111
TT-222
FT-111
FT-112
PT-111
PT-112
102
RBM Plant Structure
Area 1
Recrc Pump #5
Exhaust Fan #1
Booster Pump #3
Motor #2
dryer #3
104
e-fficiency Plant Structure
Area 1
Recrc Pump #5
Booster Pump #3
Compressor #1
Heat Exchanger #1
Heat Exchanger #2
Heat Exchanger #3
106

FIG. 18

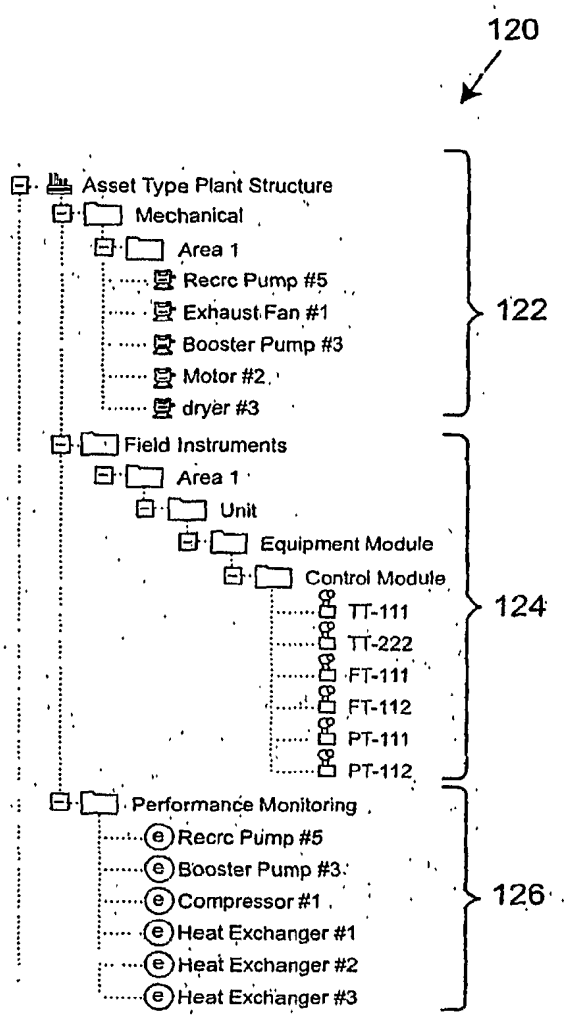

120
Asset Type Plant Structure
Mechanical
Area 1
Recrc Pump #5
Exhaust Fan #1
Booster Pump #3
Motor #2
dryer #3
122
Field Instruments
Area 1
Unit
Equipment Module
Control Module
TT-111
TT-222
FT-111
FT-112
PT-111
PT-112
124
Performance Monitoring
Recrc Pump #5
Booster Pump #3
Compressor #1
Heat Exchanger #1
Heat Exchanger #2
Heat Exchanger #3
126

FIG. 19

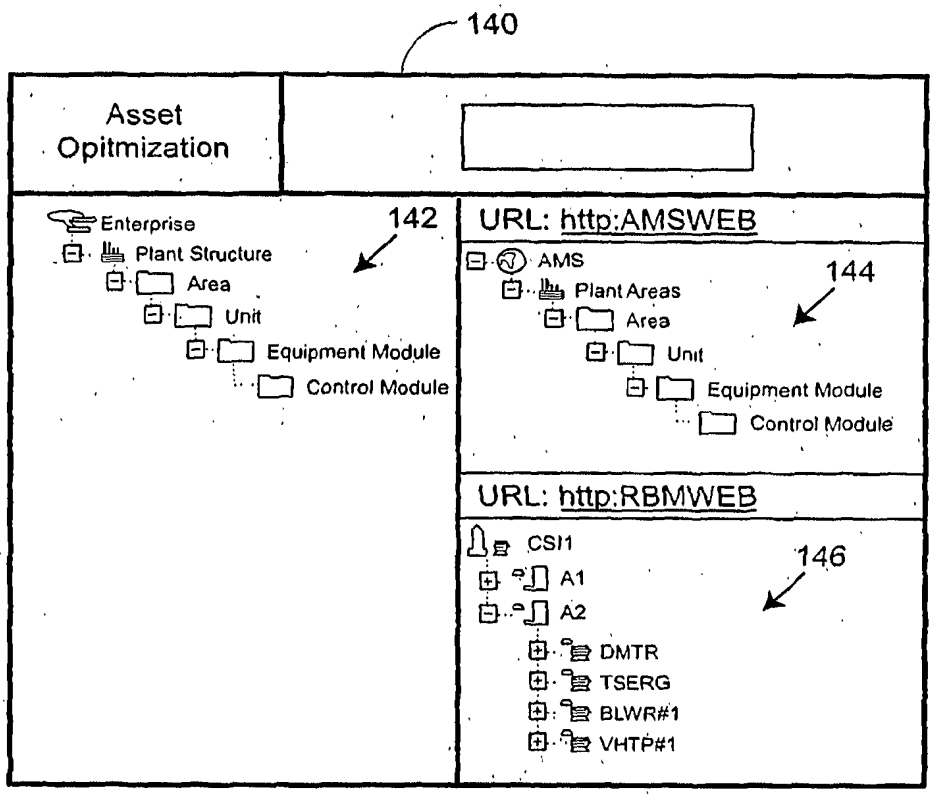

140
Asset
Opitmization
Enterprise
Plant Structure
Area
Unit
Equipment Module
Control Module
142
URL: http:AMSWEB
AMS
Plant Areas
Area
Unit
Equipment Module
Control Module
144
URL: http:RBMWEB
CSI1
A1
A2
DMTR
TSERG
BLWR#1
VHTP#1
146

FIG. 20

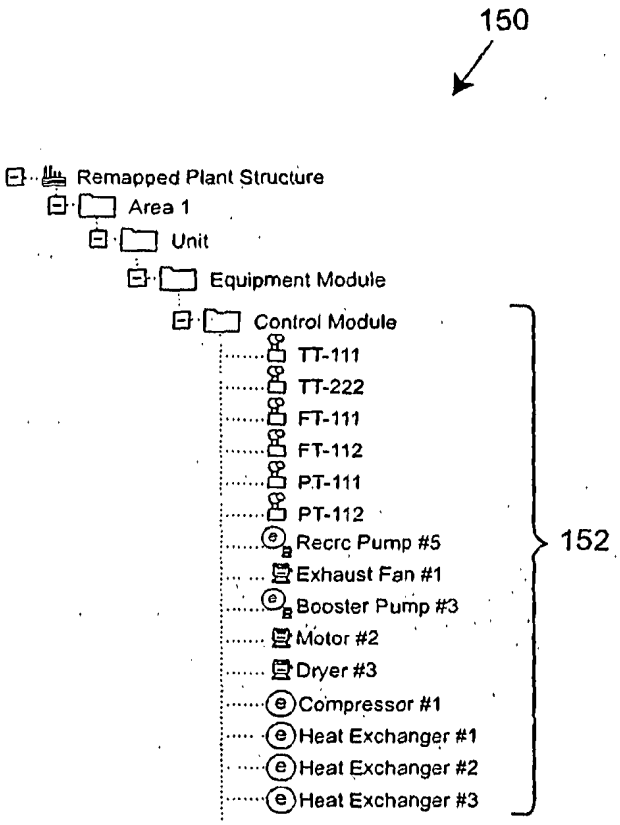

150
Remapped Plant Structure
Area 1
Unit
Equipment Module
Control Module
TT-111
TT-222
FT-111
FT-112
PT-111
PT-112
Recrc Pump #5
Exhaust Fan #1
Booster Pump #3
Motor #2
Dryer #3
Compressor #1
Heat Exchanger #1
Heat Exchanger #2
Heat Exchanger #3
152

FIG. 21

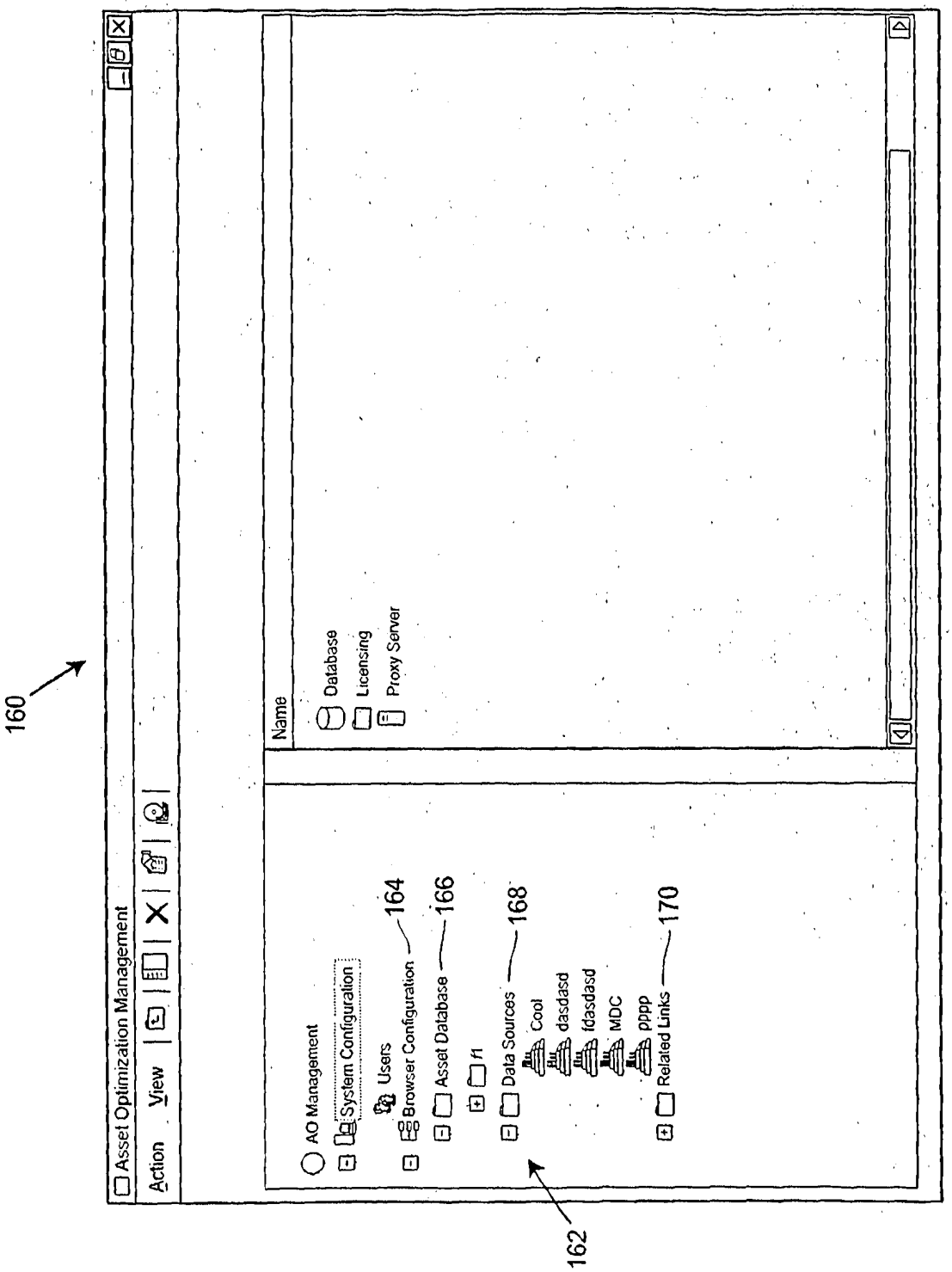

160
Asset Optimization Management
Action
View
AO Management
System Configuration
Users
Browser Configuration
Asset Database
f1
Data Sources
Cool
dasdasd
fdasdasd
MDC
pppp
Related Links
Name
Database
Licensing
Proxy Server
162
164
166
168
170

FIG. 22

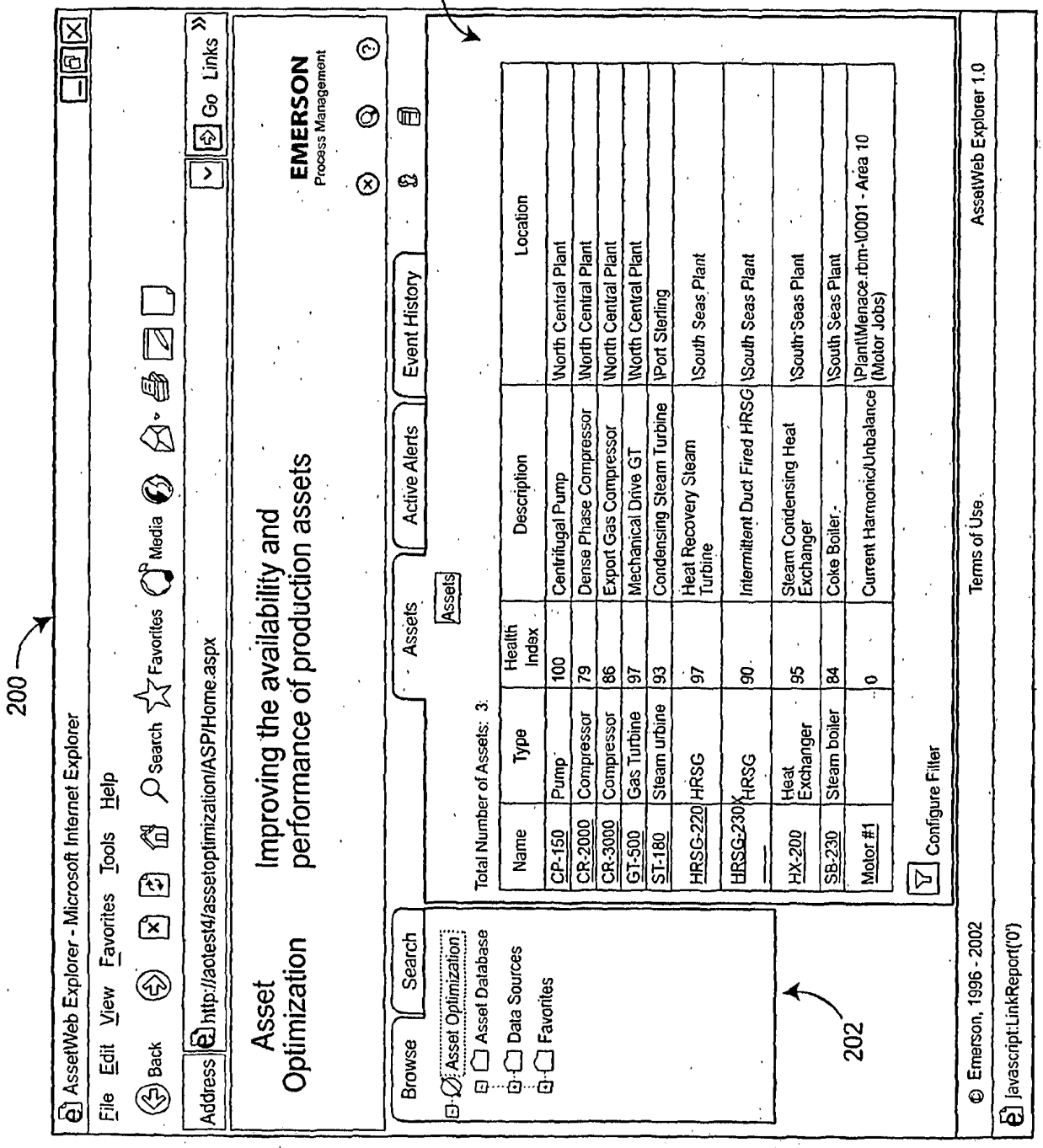

200
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aotest4/assetoptimization/ASP/Home.aspx
Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse
Search
Assets
Active Alerts
Event History
204
Asset Optimization
Asset Database
Data Sources
Favorites
202
Assets
Total Number of Assets: 3
Name
Type
Health Index
Description
Location
CP-150
Pump
100
Centrifugal Pump
\North Central Plant
CR-2000
Compressor
79
Dense Phase Compressor
\North Central Plant
CR-3000
Compressor
86
Export Gas Compressor
\North Central Plant
GT-500
Gas Turbine
97
Mechanical Drive GT
\North Central Plant
ST-180
Steam urbine
93
Condensing Steam Turbine
\Port Sterling
HRSG-220
HRSG
97
Heat Recovery Steam Turbine
\South Seas Plant
HRSG-230
HRSG
90
Intermittent Duct Fired HRSG
\South Seas Plant
HX-200
Heat Exchanger
95
Steam Condensing Heat Exchanger
\South Seas Plant
SB-230
Steam boiler
84
Coke Boiler
\South Seas Plant
Motor #1
0
Current Harmonic/Unbalance
\Plant\Menace.rbm-10001 - Area 10 (Motor Jobs)
Configure Filter
© Emerson, 1996 - 2002
Terms of Use
AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 23

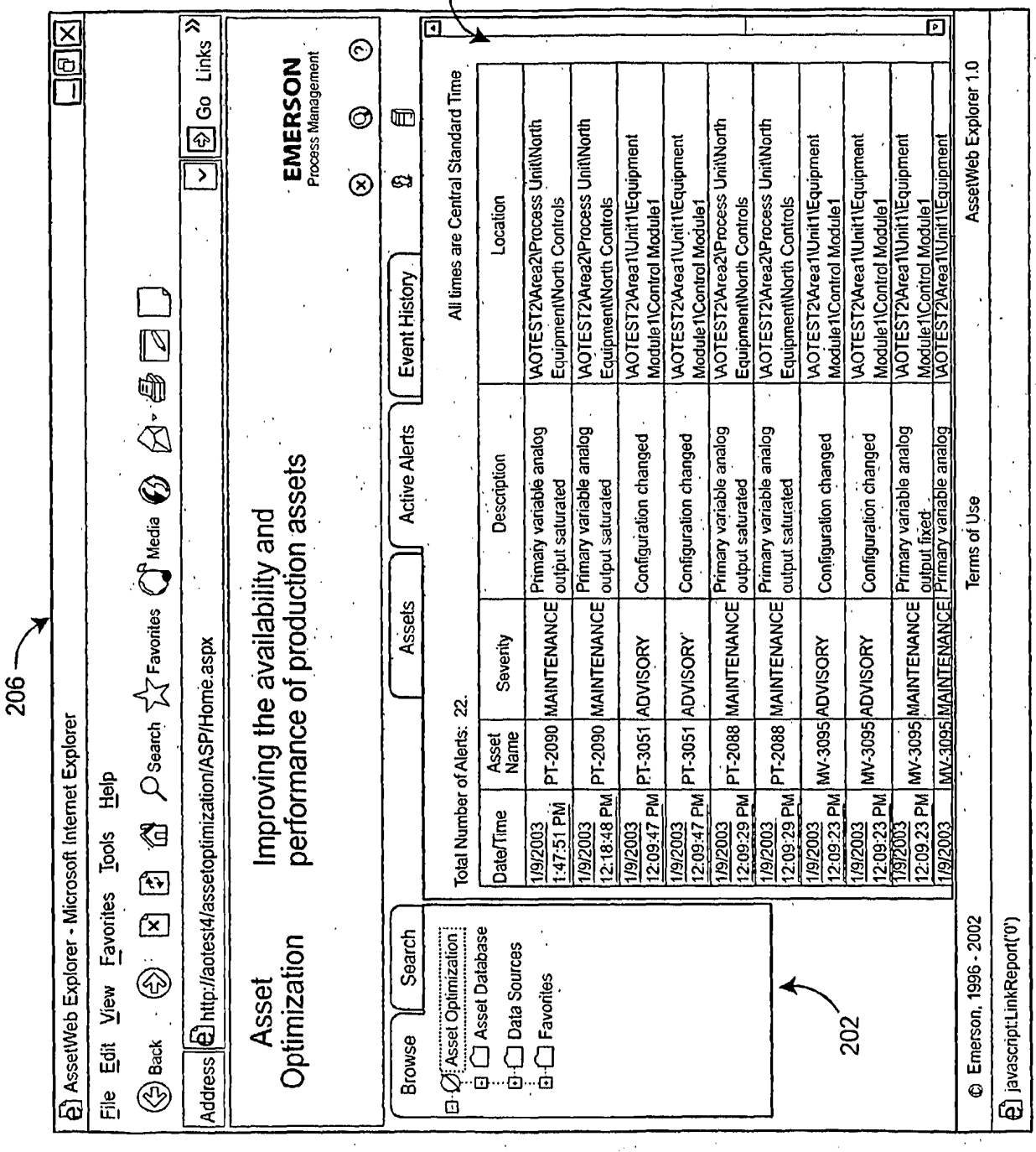
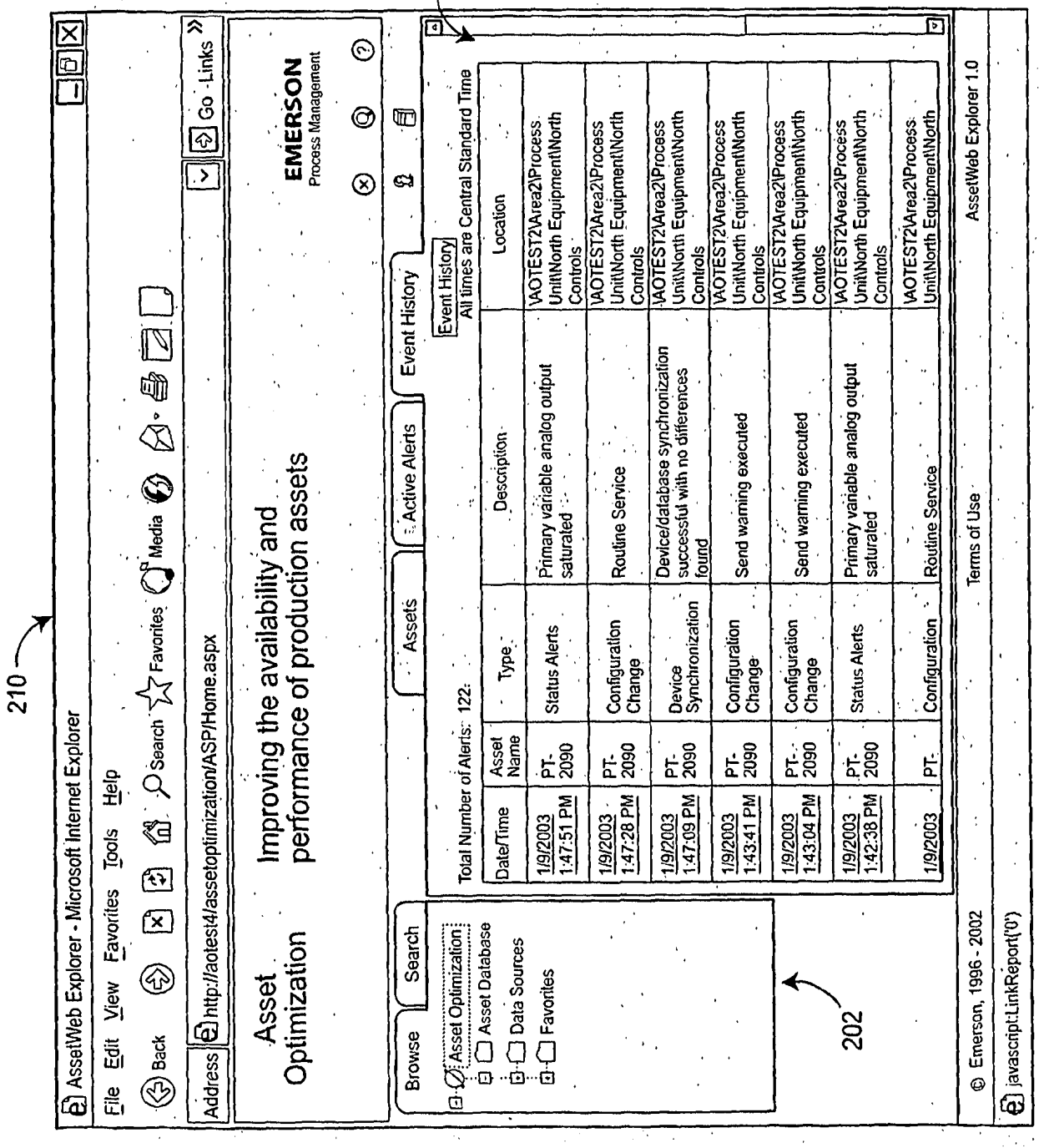

206
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media Go Links
Address http://aotest4/assetoptimization/ASP/Home.aspx
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse Search
Asset Optimization
Asset Database
Data Sources
Favorites
202
Assets
Active Alerts
Event History
208
Total Number of Alerts: 22.
All times are Central Standard Time
Date/Time | Asset Name | Severity | Description | Location
1/9/2003 1:47:51 PM | PT-2090 | MAINTENANCE | Primary variable analog output saturated | \AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 12:18:48 PM | PT-2090 | MAINTENANCE | Primary variable analog output saturated | \AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 12:09:47 PM | PT-3051 | ADVISORY | Configuration changed | \AOTEST2\Area1\Unit1\Equipment Module1\Control Module1
1/9/2003 12:09:47 PM | PT-3051 | ADVISORY | Configuration changed | \AOTEST2\Area1\Unit1\Equipment Module1\Control Module1
1/9/2003 12:09:29 PM | PT-2088 | MAINTENANCE | Primary variable analog output saturated | \AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 12:09:29 PM | PT-2088 | MAINTENANCE | Primary variable analog output saturated | \AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 12:09:23 PM | MV-3095 | ADVISORY | Configuration changed | \AOTEST2\Area1\Unit1\Equipment Module1\Control Module1
1/9/2003 12:09:23 PM | MV-3095 | ADVISORY | Configuration changed | \AOTEST2\Area1\Unit1\Equipment Module1\Control Module1
1/9/2003 12:09:23 PM | MV-3095 | MAINTENANCE | Primary variable analog output fixed | \AOTEST2\Area1\Unit1\Equipment Module1\Control Module1
1/9/2003 | MV-3095 | MAINTENANCE | Primary variable analog | \AOTEST2\Area1\Unit1\Equipment
© Emerson, 1996 - 2002 Terms of Use AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 24


210
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aotest4/assetoptimization/ASP/Home.aspx
Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse
Search
Asset Optimization
Asset Database
Data Sources
Favorites
202
Assets
Active Alerts
Event History
212
Event History
All times are Central Standard Time
Total Number of Alerts: 122
Date/Time
Asset Name
Type
Description
Location
1/9/2003 1:47:51 PM
PT-2090
Status Alerts
Primary variable analog output saturated
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 1:47:28 PM
PT-2090
Configuration Change
Routine Service
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 1:47:09 PM
PT-2090
Device Synchronization
Device/database synchronization successful with no differences found
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 1:43:41 PM
PT-2090
Configuration Change
Send warning executed
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 1:43:04 PM
PT-2090
Configuration Change
Send warning executed
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003 1:42:38 PM
PT-2090
Status Alerts
Primary variable analog output saturated
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
1/9/2003
PT-
Configuration
Routine Service
\AOTEST2\Area2\Process Unit\North Equipment\North Controls
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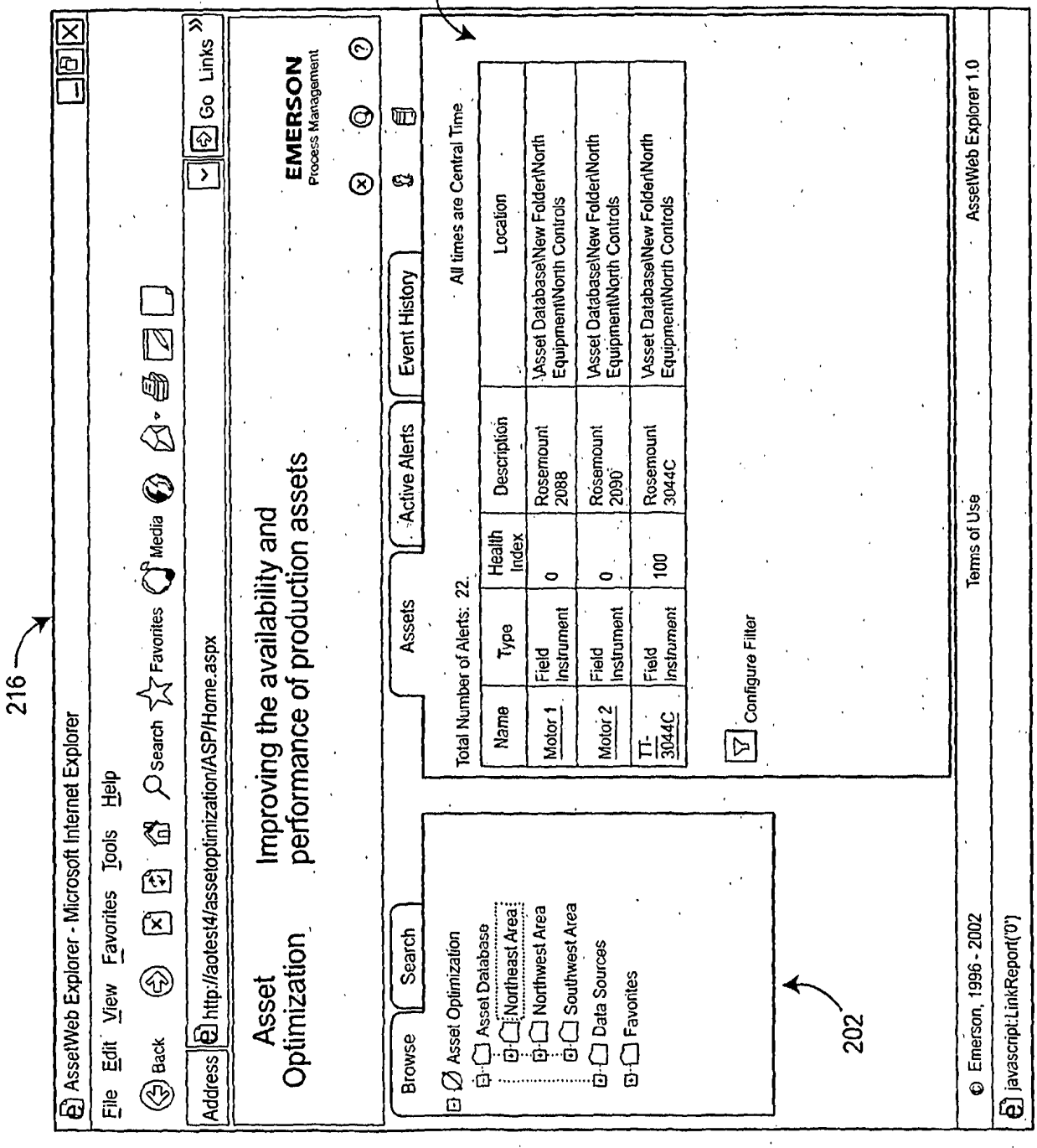
Terms of Use
AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 25


216
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
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Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse
Search
Asset Optimization
Asset Database
Northeast Area
Northwest Area
Southwest Area
Data Sources
Favorites
202
Assets
Active Alerts
Event History
218
Total Number of Alerts: 22.
All times are Central Time
Name
Type
Health Index
Description
Location
Motor 1
Field Instrument
0
Rosemount 2088
\Asset Database\New Folder\North Equipment\North Controls
Motor 2
Field Instrument
0
Rosemount 2090
\Asset Database\New Folder\North Equipment\North Controls
TT-3044C
Field Instrument
100
Rosemount 3044C
\Asset Database\New Folder\North Equipment\North Controls
Configure Filter
© Emerson, 1996 - 2002
Terms of Use
AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 26

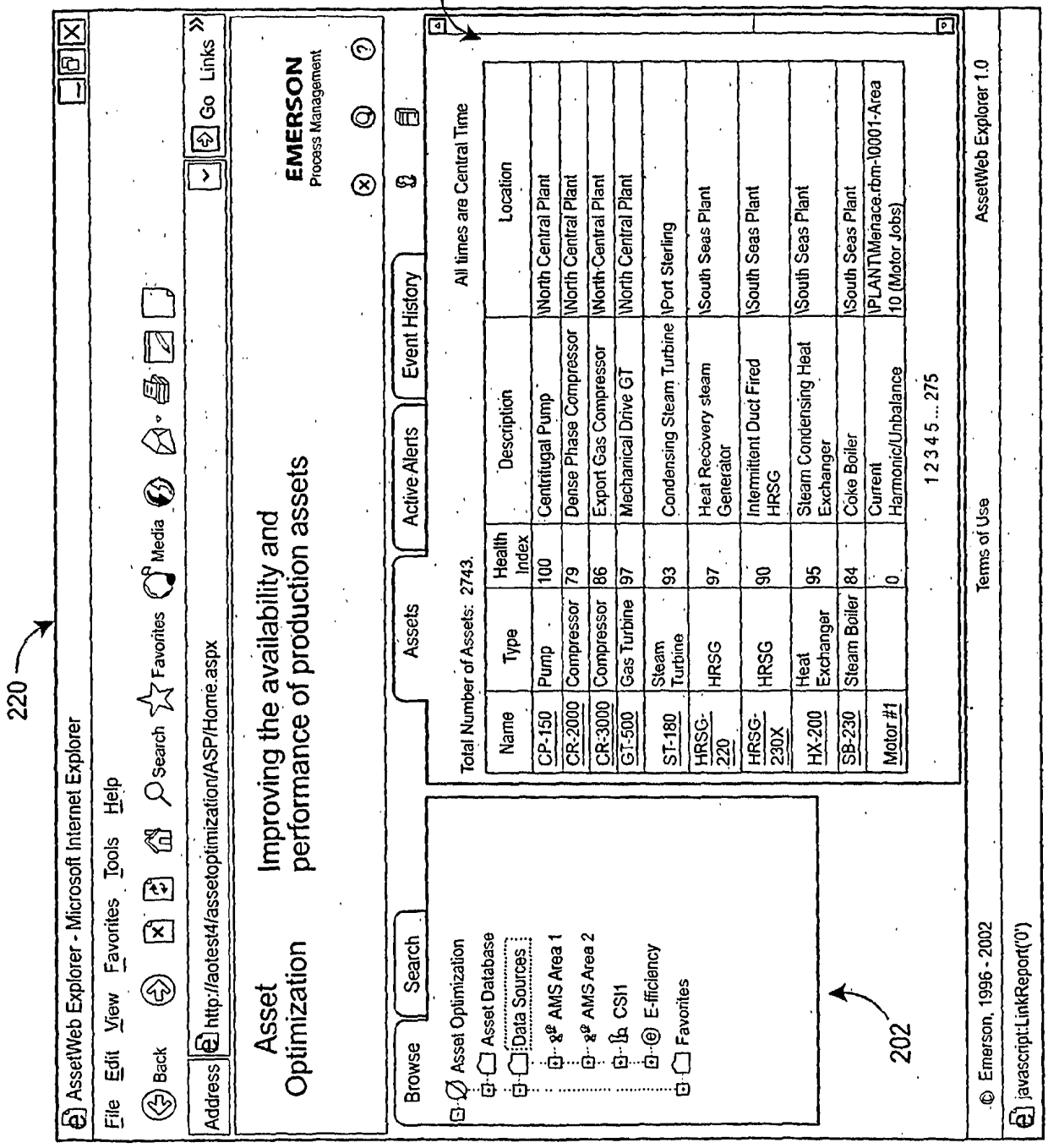

220
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aotest4/assetoptimization/ASP/Home.aspx
Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse
Search
Assets
Active Alerts
Event History
222
Asset Optimization
Asset Database
Data Sources
AMS Area 1
AMS Area 2
CSI1
E-fficiency
Favorites
202
Total Number of Assets: 2743.
All times are Central Time
Name
Type
Health Index
Description
Location
CP-150
Pump
100
Centrifugal Pump
\North Central Plant
CR-2000
Compressor
79
Dense Phase Compressor
\North Central Plant
CR-3000
Compressor
86
Export Gas Compressor
\North Central Plant
GT-500
Gas Turbine
97
Mechanical Drive GT
\North Central Plant
ST-180
Steam Turbine
93
Condensing Steam Turbine
\Port Sterling
HRSG-220
HRSG
97
Heat Recovery steam Generator
\South Seas Plant
HRSG-230X
HRSG
90
Intermittent Duct Fired HRSG
\South Seas Plant
HX-200
Heat Exchanger
95
Steam Condensing Heat Exchanger
\South Seas Plant
SB-230
Steam Boiler
84
Coke Boiler
\South Seas Plant
Motor #1
0
Current Harmonic/Unbalance
\PLANT\Menace.rbm-10001-Area 10 (Motor Jobs)
1 2 3 4 5 ... 275
© Emerson, 1996 - 2002
Terms of Use
AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 27

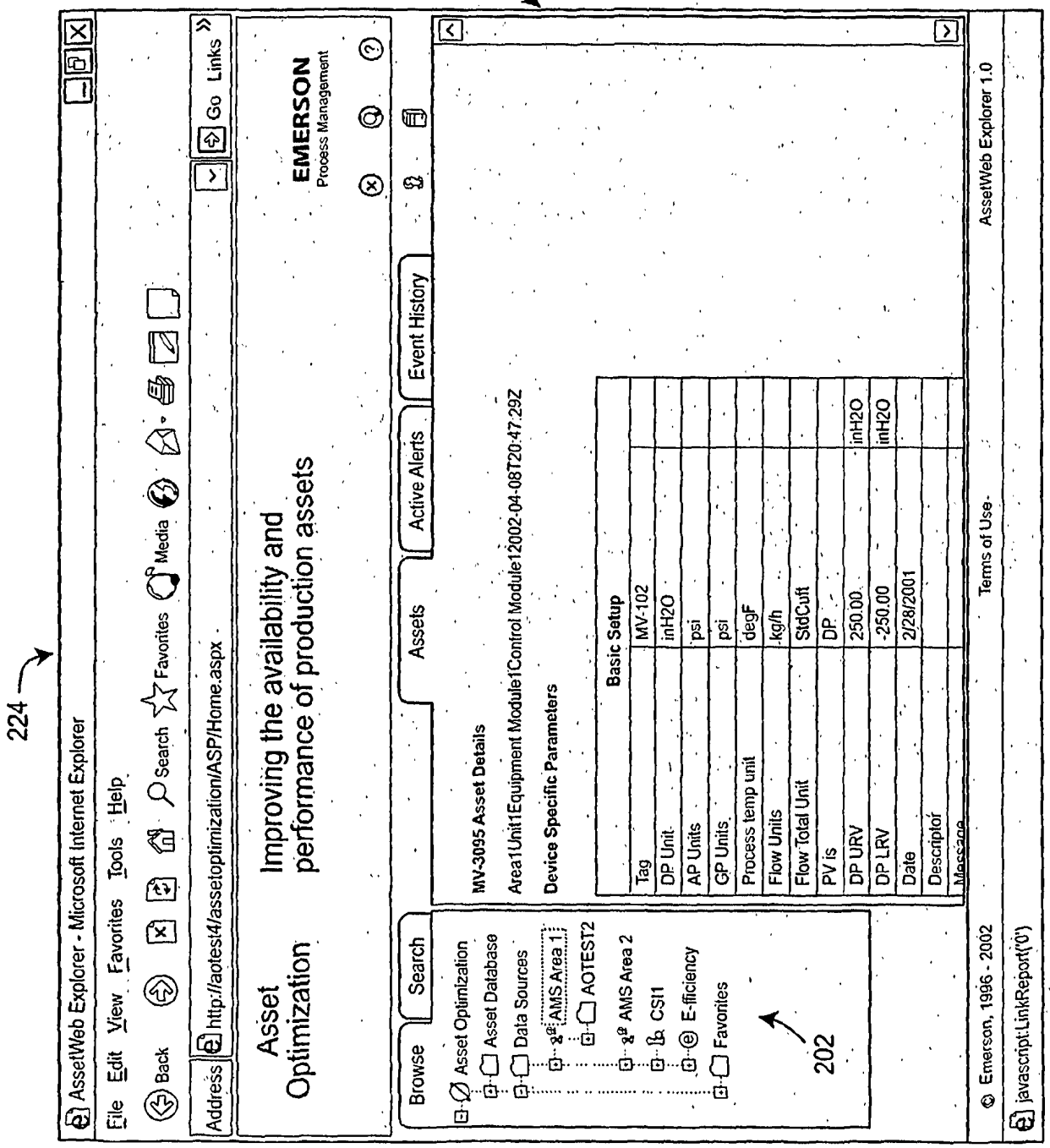
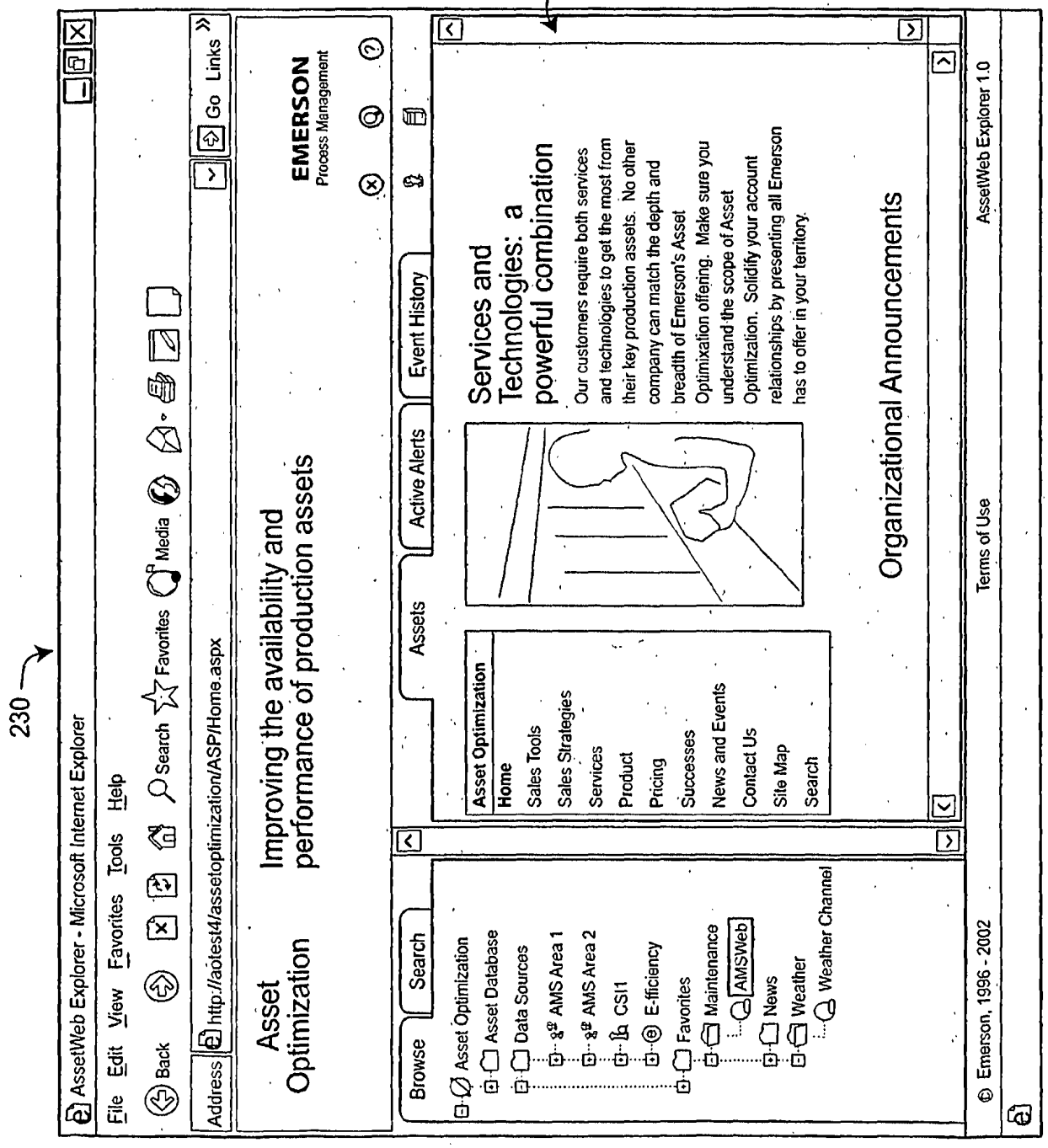

224
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aotest4/assetoptimization/ASP/Home.aspx
Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse
Search
Assets
Active Alerts
Event History
226
Asset Optimization
Asset Database
Data Sources
AMS Area 1
AOTEST2
AMS Area 2
CSI1
E-fficiency
Favorites
202
MV-3095 Asset Details
Area1Unit1Equipment Module1Control Module12002-04-08T20:47:292
Device Specific Parameters
Basic Setup
Tag MV-102
DP Unit inH2O
AP Units psi
GP Units psi
Process temp unit degF
Flow Units kg/h
Flow Total Unit StdCuft
PV is DP
DP URV 250.00 inH2O
DP LRV -250.00 inH2O
Date 2/28/2001
Descriptor
Message
© Emerson, 1996 - 2002
Terms of Use
AssetWeb Explorer 1.0
javascript:LinkReport('0')

FIG. 28


230
AssetWeb Explorer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://aotest4/assetoptimization/ASP/Home.aspx
Go Links
Asset Optimization
Improving the availability and performance of production assets
EMERSON
Process Management
Browse Search
Assets Active Alerts Event History
Asset Optimization
Home
Sales Tools
Sales Strategies
Services
Product
Pricing
Successes
News and Events
Contact Us
Site Map
Search
Services and Technologies: a powerful combination
Our customers require both services and technologies to get the most from their key production assets. No other company can match the depth and breadth of Emerson's Asset Optimization offering. Make sure you understand the scope of Asset Optimization. Solidify your account relationships by presenting all Emerson has to offer in your territory.
Organizational Announcements
232
Asset Optimization
Asset Database
Data Sources
AMS Area 1
AMS Area 2
CSI1
E-fficiency
Favorites
Maintenance
AMSWeb
News
Weather
Weather Channel
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AssetWeb Explorer 1.0

FIG. 29

INTERNATIONAL SEARCH REPORT

ıational Application No
'US2004/008413

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G05B19/418

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/95041 A (HONEYWELL LTD ; MCADAM ROHAN J (AU); CHAPMAN DAVID JOHN (AU); DOWLING) 13 December 2001 (2001-12-13) page 1, line 3 - line 15 page 3, line 29 - line 31 page 5, line 1 page 64, line 24 - line 27 page 69, line 4 - line 9 figure 22	1-44
A	US 5 619 638 A (DUGGAN HUGH ET AL) 8 April 1997 (1997-04-08) the whole document	1-44

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 August 2004	06/09/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Sundin, M

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

ıational Application No
'/US2004/008413

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"FACTORY MONITORING VIA THE INTERNET" MACHINE DESIGN, PENTON,INC. CLEVELAND, US, vol. 69, no. 6, 20 March 1997 (1997-03-20), page 34, XP000726280 ISSN: 0024-9114 the whole document	1-44

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

Information on patent family members

ational Application No
/US2004/008413

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0195041 A	13-12-2001	WO 0195041 A1	13-12-2001
		AU 5184301 A	13-12-2001
		CA 2411142 A1	13-12-2001
		US 2004021679 A1	05-02-2004
US 5619638 A	08-04-1997	EP 0433433 A1	26-06-1991
		WO 9102307 A1	21-02-1991